RADIO & TELEVISION NEWS

FEBRUARY
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ULTRA MODERN VIDEO CONTROL AT WOR-TV... N.Y.C. PAGE 36

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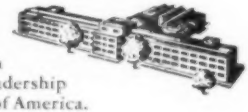

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COVER PHOTO. Frank Gerufy, transmitter engineer, and James Long, video engineer, at the studio controls of WOR-TV, the New York area's newest video station. (Kodachrome by Edward Ozern)

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Radio & Television News Trademark Reg. U.S. Pat. Office No. 517025

CONTENTS — FEBRUARY, 1950

DEPARTMENTS

VOLUME 43 ● NUMBER 2

RADIO & TELEVISION NEWS is published monthly at the Ziff-Davis Publishing Company, 185 N. Wabash Ave., Chicago 1, Ill. Subscription Rates: in the United States $4.00 for 12 issues, single copies 35c; in Canada $5.00 for 12 issues, single copies 40c; in Mexico, South and Central America, and U. S. Possessions, $4.00 for 12 issues; in British Empire, $5.00 for 12 issues; all other foreign countries, $5.00 for 12 issues. Subscribers should allow at least 2 weeks for change of address. All communications about subscriptions should be addressed to: Director of Circulation, 185 N. Wabash Ave., Chicago 1, Ill. Entered as second class matter July 21, 1945, at the Post Office, Chicago, Illinois, under the Act of March 3, 1879. Entered as second class matter at the Post Office Dept., Ottawa, Canada. Contributors should retain a copy of contributions and include return postage. Contributions will be handled with reasonable care but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever revisions and future changes that are necessary. Payment made at our current rates, covers all authors' contributors' or contestants' rights, title and interest in and to accepted material, including photographs and drawings.

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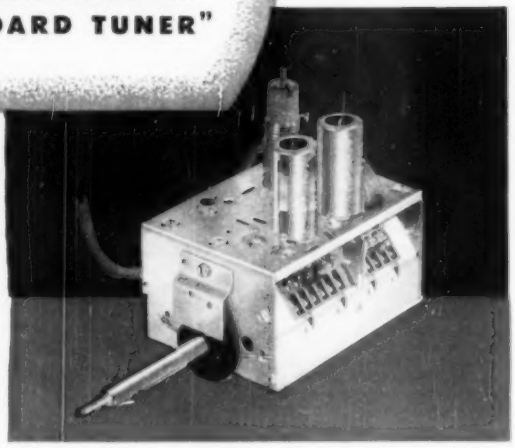

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For the RECORD

BY THE EDITOR

WHY THE RUSH FOR COLOR TELEVISION?

SEEMS like every few hours someone calls to request information on the status of color television. "Should I wait until Spring so I can buy one with color?," "Which, in your opinion, is the best set for color television?," "I understand we are to have color soon and my present set will then be obsolete," and many similar statements.

The public, apparently impressed with news items read in its daily newspapers, is generally of the opinion that color television is "just around the corner." People forget, however, that they waited many years for our present monochrome (black and white) to emerge from "just around the corner."

Television, in its present form, has reached the stage where further improvements will be made largely at the transmitting end, rather than within the receivers. One of the greatest improvements will come from camera techniques. A majority of programs seen, especially remote pickups, suffer from the lack of picture quality, not from the equipment itself, but because of the careless use of monitors and other pickup techniques.

But these troubles will soon be ironed out and the public will then enjoy picture quality comparable to motion pictures. Then, and only then, will proper groundwork be laid for expanding into color video with its increased problems of register, tonal balance, and a host of other details that must be perfected before color will be acceptable. It took years of painstaking research and experiment to perfect what we now have and it will take an even greater period of time for color television to reach equal acceptance by the public.

It will take time to complete coax links—spreading like a giant web across the country—before the public can enjoy really worthwhile programs that originate from principal TV centers. Television set customers in remote areas soon tire of mediocre tele-transcriptions and a steady diet of old movie films. They want the real thing. These folks certainly would prefer good monochrome now and would be content to wait for color.

TV technicians will have plenty of time to learn the intricacies of monochrome circuits before color emerges from its swaddling clothes, if we take time to perfect a good compatible system. That's good all around!

In our opinion, color television will not reach the acceptance stage for many, many moons. The ballyhoo on color television, if continued, could even kill off that which the public now enjoys.

We are simply not ready for color! So why all the premature dreaming that we will soon be seeing stuff comparable to Technicolor movies—right in our own living room—within a few months? Who's kidding whom? Even newspapers owning and operating television stations, who should know better, treat color television as something ready for production as soon as the FCC decides on a system.

It is not that simple. We have seen several of the color television systems which are now being discussed at lengthy hearings in Washington, which in all probability will continue for some time to come, and we personally wouldn't want any one of the receivers in our own homes. It would take a staff of video experts to keep some of them operating—just for an evening.

Exaggerated claims of color television have done much to instill doubt in the minds of many potential video customers and even today many hesitate to invest in a television receiver simply because they have been led to believe that their sets would soon be obsolete. Some believe in the theory that color will be the ultimate in television. We doubt if that will ever be so. Perhaps it was a mistake on the part of the Industry to rush into the matter of color video. Wouldn't it have been better to have completely developed the huge market existing for black and white and to provide the masses with the best possible monochrome before even considering the addition or substitution of color?

Several of the systems under development do show promise. Unfortunately the better systems fall short of being compatible. It may be that a combination of systems can be devised, utilizing the best features of each, which will result in something really worth considering. Only time will tell. Television dealers and technicians can do a real service to the public by giving them the facts on the status of color television.

Yes, color television will be a reality in the future. However, let's stop telling the public "It's just around the corner." . . . . . O. R.

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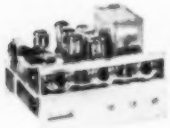

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You construct the Transitron Signal Generator shown here, demonstrating Transitron principles in both R.F. and A.F. stages. You study negative type oscillators at firsthand.

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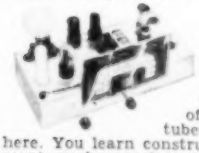
An electronic device, which produces audio-frequency signals for modulating R.F. (radio frequency) carrier waves, testing A.F. (audio frequency) amplifiers, speakers, etc.



T.R.F. RECEIVER

You build several T.R.F. Receivers, one of which, a 4-tube set, is shown here. You learn construction, alignment, make receiver tests, and do trouble shooting.

YOU LEARN BY DOING

You receive special laboratory experiment lessons to show you how to build with your own hands various experimental units such as those shown at left, and how to conduct many tests.

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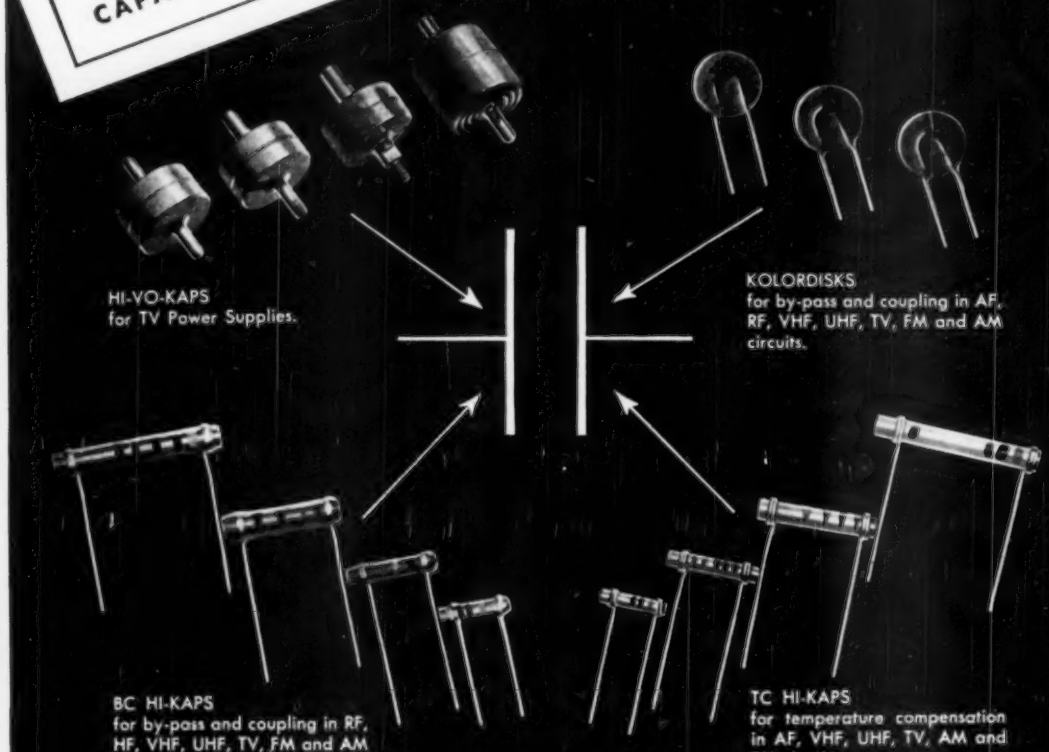

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WHEN YOU use high quality Centralab replacement capacitors in repairing radio sets, television receivers and other electronic equipment, you can be sure of customer satisfaction. You can be sure of new business. What's more, Centralab capacitors — *Hi-Vo-Kaps, Kolordisks, TC* and *BC Hi-Kaps* — make your job easier, save you time. Here's why. They're simple to install . . . easy to stock. Get all the facts on profit-making CRL replacement capacitors from your nearby Centralab distributor.

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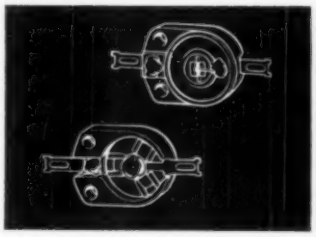
Ask Your Distributor for These CRL Parts



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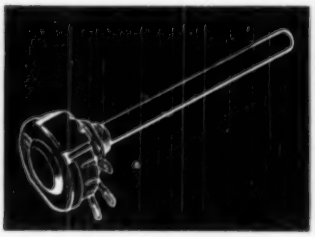
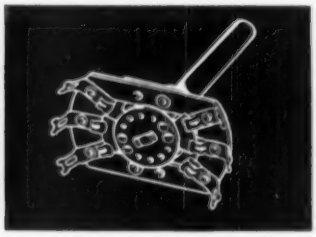
CERAMIC TRIMMERS for padder application in RF and HF circuits. These trimmers are noted for their great mechanical strength and electrical stability; low power factor. Hold circuit drift to a minimum. Truly an indispensable "must." Ideal for amateur, experimental and industrial use.



CONTROLS

MODEL "M" for voltage-divider, antenna shunt and "C" bias control, tone control, AF grid control. MODEL "1" for all miniature applications; rated at 1/10 watt, actually smaller than a dime. MODEL "R", wire wound, for voltage divider, antenna shunt, "C" bias, AF grid or tone control circuits.



SWITCHES

ROTARY for band change, meter, intercom circuits; made in ceramic and phenolic models. ROTARY SPRING RETURN for meter selection, intercom, phono-radio applications. MEDIUM DUTY for band changing in low power exciter-transmitters and receivers. LEVER ACTION for intercom, speaker, microphone and other applications.

NEW G-E *Triple-Play* CARTRIDGE PLAYS ALL 3 SPEEDS

Latest Dual Stylus Unit Tracks 33-1/3, 45, and 78 rpm Records at Constant Pressure

Costs 25% less than Pickups it Replaces

A new General Electric "Triple Play" Cartridge that tracks any commercial record is now available to manufacturers, distributors, and dealers.

Simplicity is the key feature of this notable electronic advancement. Once installed in a tone arm, the cartridge will play all types of popular narrow groove and standard groove records *without replacement or even a change in position!*

ONLY ONE PRESSURE

The new cartridge retains the unsurpassed frequency response characteristics of the famous G-E Variable Reluctance unit and in addition, tracks the three types of records at 6 to 8 grams. Thus the pressure is constant regardless of the stylus you're using. The special design of the "Triple Play" permits precise adjustment of tone arm pressure. Weight changing and pressure compromise problems are eliminated. High compliance and low moving mass reduce record wear to a minimum.

TWO STYLI IN ONE CARTRIDGE

A single twist of a built-in knob turns either end of a dual stylus to playing position. A 1-mil stylus, mounted at one end, plays 33⅓ and 45 rpm records, and a 3-mil stylus, at the opposite end, tracks standard 78 rpm records.

MANUFACTURERS NOTE LOW COST

Although it plays records that formerly required the use of two cartridges, the price of the "Triple Play" is 25% *less* than the price of two individual cartridges. It is adaptable to many types of tone arms and *its use as an initial component will effectively reduce set manufacturing costs.*

UNAFFECTED BY TEMPERATURE

The G-E "Triple Play" is unaffected by normal climatic changes in humidity and extreme variations in temperature. Needle talk and needle scratch are reduced to a minimum. Record reproduction—as always with G-E Cartridges—is superb. Mail coupon below for complete information.

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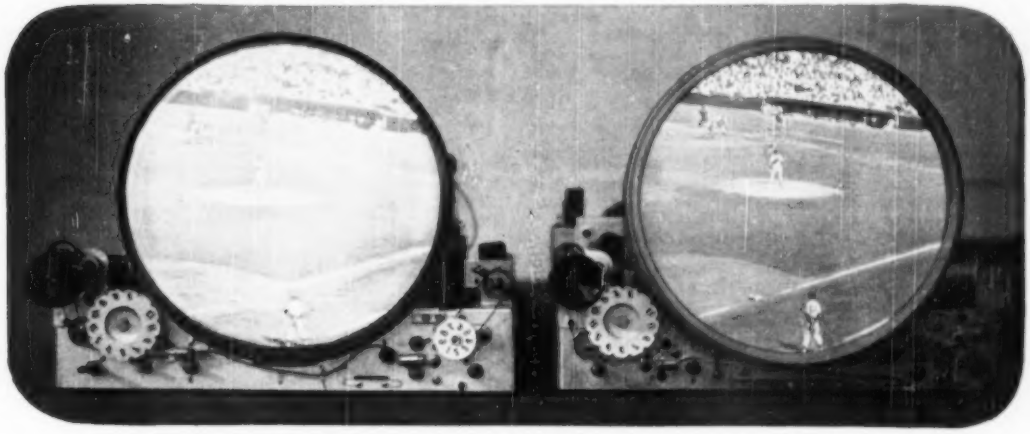
2 The light-weight 12" metal tube—still available only from Rauland. *And now . . .*

3 THE SENSATIONAL NEW RAULAND LUXIDE SCREEN WITH ITS VISIBLY BETTER CONTRAST AND CLARITY



Luxide Screen (right) shows how improved contrast and clarity under high ambient light eliminates "washing out." (Standard tube at left.)

No single improvement in Television has won such quick and enthusiastic public acceptance as the Rauland Luxide Screen (black) picture tube—pioneered by Rauland from its conception to its present universal acceptance.

Rauland—first manufacturer of tubes of this type—received its initial production quantity of Luxide tube faces in mid-June, 1949. Sets featuring these new tubes were announced to the public in September. The public received them with such enthusiasm that the Television industry, almost without exception, has already adopted this Rauland-developed idea and now offers it under a variety of names.

The Rauland Luxide Screen improves picture quality by greatly reducing two former troubles—first, reflection of ambient light and second, halation within the tube face. The results to the viewer are a great reduction in apparent "blurring" and a much improved contrast and clarity, especially in lighted rooms. The improvement is so impressive that it has been given considerable editorial publicity.

Rauland is glad to have made another important contribution to the Television industry and the Television viewing public. The headline-making Luxide Screen is an additional example of Rauland's "Perfection Through Research."

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Spot Radio News

★ *Presenting latest information on the Radio Industry.*

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

COLOR TV. probably the most controversial subject since the KDKA days of broadcasting and certainly the seething topic of '49, ripped into the new year with quite a banner assignment direct from the seven men who are judging the future of green, red, and blue in video. The assignment, a field test, and all three who have color systems, *RCA, CBS* and *CTI*, were involved.

Colorcasting for a thirty-day period was ordered by the Commissioners to a representative assortment of receivers distributed among . . . "technical and non-technical persons who are not connected with the development of the system." The request, issued in the closing hours of the comparison tests, created quite a furore, since a representative assortment of receivers was just not available and only perhaps a wartime-type emergency production plan might, it was believed, produce the sets. And whatever models could be produced would be on a very limited basis, was the general consensus. The unfortunate interpretation of the test ruling by the general press, cited as a wide-scale public check of color TV, added to the general discomfort of everyone and brought sleepless nights to many a plant man who wondered just how they could race out all the sets required and at a sensible price. Many of the production experts agreed that the receivers would, in the main, be handmade types and certainly quite costly. Commenting on the latter point, a representative of one manufacturer predicted that the cost of about one hundred models which they expected to produce, would be in the neighborhood of a quarter of a million dollars. This spokesman declared that the sets would not be sold, but loaned out to a group of viewers.

As this column was being written, manufacturers were processing the test sets and shipping to locations which should produce the information sought by the FCC. Data that the Commission hoped to collect as a result of the test were expected to cover resolution or definition, brightness, contrast and flicker, registration, color fidelity and spurious images. Also to be explored during the tests were the desired-to-undesired signal ratios in a variety of combinations: monochrome to color, color on color receiver to monochrome, color on color set to color, color on black and white receiver to monochrome and color in the black and white model to color. There were also to be reviewed signal-to-interference ratios. This study was expected to include tests where the undesired signals are continuous waves other than TV signals, such as oscillator radiation and diathermy interference. The FCC also asked that the tests should include representative carrier differences such as result from the use of standard intermediate frequencies, with particular attention being paid to critical carrier frequency differences. Results from susceptibility to various types of impulse and random noise were also to be reported, with emphasis on the troubles caused by auto ignition, and industrial and home-type electrical equipment.

Four classifications of receivers were described by the FCC as being representative for the tests: Black and white models, adapted to provide monochrome reception from color transmitters; converted or adapted receivers to provide color reception; new monochrome models capable of picking up black and white signals from colorcasts; and color receivers specially built for all color reception.

Observers have been asked to select a viewing distance, within four to twelve times the picture height, when the normal picture is free from interference, and base their reports on their reaction to fixed or variable viewing distances. Information on highlight brightness and contrast required in the room are also being compiled for the Commission, with specific data on the room lighting used during the tests. The FCC suggested that values of room illumination selected should be those representative of the lighting required by one or more persons when reading a newspaper.

Not only have the present bands been selected for study, but the higher 470 to 890 region, too, the FCC hoping to be able to correlate the results on both of these bands for allocation purposes. Transmitter manufacturers are being asked to disclose powers available, frequency stabilitiy of visual and aural carriers, particularly

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Peak-to-peak voltages of TV-receiver waveforms can be read at all times during operation. The frequency-compensated vertical range control is graduated in five voltage steps of 3-to-1 ratio which, together with a built-in calibrating voltage source, facilitates voltage measurements over any extended range.

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The vertical amplifier of the WO-58A has a useful range from 1 cycle to 4 megacycles. Its characteristics of tilt, overshoot, and rise time are excellent. As a result of its unusual transient-response performance, the WO-58A provides accurate traces of sync pulses and other steep wave fronts. *Supplied complete* with crystal probe, direct probe, and low-capacitance probe. *See your RCA Test Equipment Distributor today for full details.*

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TEST EQUIPMENT HARRISON, N. J.

the relative stability as it affects the intercarrier type receivers. Receiver makers were also involved in the higher band quiz, they were being asked to disclose the selectivity, sensitivity, oscillator stability, oscillator radiation and image and other spurious response characteristics of their models designed for the high channels.

The results of these tests are expected to become available at the second comparative test session, scheduled to begin just about the time this issue goes into the mailbag.

The first comparison studies, which apparently prompted the sensational decision to hold field tests, resulted in a barrage of explosive comments on the merits of the systems displayed.

An official spokesman for *RCA* declared that the images on their receivers were . . . "far brighter and truer in color fidelity than in earlier tests. Operation was stable and completely free of flicker."

Dr. C. B. Jolliffe, executive vice-president in charge of *RCA Labs*, said: "All proponents of the art should be impressed by this demonstration. . . . Experience has taught us that the whirling mechanical disk has no place in home television."

The *Columbia* camp was far from quiet with opinions. Said Adrian Murphy, *CBS* vice-prexy: "The color fidelity of the *CBS* system once again has been proved way out in front. The colors in the *CBS* picture were highly faithful to the original subject matter and were stable."

The enthusiasm for the color results was not shared by Dr. Allen B. DuMont who declared that neither system was adequate. In one, he said, the color changed every minute, and in the other the color fidelity was poor.

To many witnesses at the tests, the *RCA* system appeared to be more stable, while the *CBS* method afforded a more faithful picture. The black and white pictures from the standard monochrome set also appeared to many to have greater definition than black and white results on the color models.

The transmission procedures employed at the tests were unique in many ways. For instance, the studios of WNBW, the *NBC* station in the Wardman-Park Hotel, originated programs for feeding to the transmitters of not only WNBW, but WOIC the *CBS* station, and WTTG the *DuMont* setup. During the demonstrations *RCA* displayed transmission over a coax cable, the signal being fed into an eight-mile loop of cable.

WASHINGTON lost its hold on the color wrangle for a few days, prior to the comparison test session, the scene shifting to London and BBC, where it had been reported color was in the offing.

The report stemmed from the trip Dr. Peter Goldmark had made to London at the invitation of the British Institute of Electrical Engineers to talk about and demonstrate his color system. According to *CBS* representatives, a system paralleling Goldmark's setup was to be built for the BBC, with complete studio facilities being developed to accommodate colorcasting activities.

When informed of the report on BBC color work, Sir Noel Ashbridge, director of technical services for the British system, declared that . . . "no definite arrangements have been made for specific tests nor is any practical development in the immediate future envisaged." Sir Noel explained that . . . "the only work in color televi ion by the BBC consists purely of research experiments."

Dr. Goldmark, commenting on the experimentation activities, said that he welcomed . . . "any experimentation by the BBC . . . and we are quite certain that its experiments with other systems in addition to ours will demonstrate the superiority of the *CBS* method."

TV surrendered its headline spot on two occasions, during the close of '49, to two other substantial users of channels, the petroleum and taxicab industries.

Commissioner E. M. Webster provided the report on petroleum and radio in a talk before the Division of Transportation of the American Petroleum Institute during its annual meeting in Chicago. Reviewing the use of the airlanes by the oil drillers, the Commissioner described how radio was used by geophysical crews in connection with seismic, gravity meter, and magnetometer surveys, as well as by other divisions of the oil wellers covering such activities as off-shore operations in the Gulf of Mexico, communications during drilling and well operations, control and safety activities involved during the construction and operation of refineries, and vital contacts in the operation of natural gas, crude, and products pipe lines.

"In the pipe line field," said the Commissioner, "radio has proved to be most useful on the long-distance, cross-country lines where gas is traveling at high pressure and velocity, and where the problem of instantaneous communications for control purposes is most critical."

Tracing the history of marine telegraphy, which played so acute a role in the early days of radio and the ships which carried oil, the Commissioner went back to the days of WCC, the call letters of the pioneer station of the Marconi Wireless Telegraph Company of America at South Wellfleet, Mass. On the ocean side of the Cape at this site in 1903, Marconi had erected his famous transmitter building, located in the center of four 210-foot lattice-work towers. In 1914, Marconi found it necessary to replace his early crude apparatus with modern equipment and a station was erected at Marion, where the Cape joins the mainland.

With the advent of World War I,

(*Continued on page* 155)

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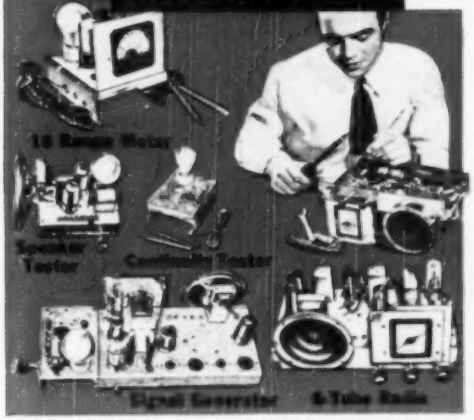

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Soon after you start training I send you my famous BUSINESS BUILDERS that show you how to make money in spare time doing interesting Radio jobs. Look at the useful and valuable equipment you get while training with me (illustrated at left)—I send you these 8 big kits of Radio parts and equipment and help you build step-by-step a powerful 6-tube superhet radio, a 16-range test meter, plus other mighty useful equipment for Radio and Television servicing. You will perform over 175 fascinating experiments while training. You will learn about Television—so that you will be qualified to step into this fast growing, profitable field. I also send you many valuable service manuals, diagrams and my book telling exactly how to set up your own Television and Radio shop. *I want you to learn all about my training*—and that is why I urge you to clip and mail the coupon below for my two big FREE Radio books. I employ no salesmen—and nobody will call on you. The important thing is to act now and get the facts.

HAVE A BUSINESS OF YOUR OWN

A profitable Radio and Television Service Shop may be started with little capital. I will show you how to get started and how to build your small business. At left is pictured one of my graduates, Mr. Merrit C. Sperry of Fairmont, Minnesota in his own shop. The way is also open for you to build a good SERVICE BUSINESS FOR YOURSELF.

ALL KITS ARE YOURS TO KEEP

Each of the hundreds of Radio parts and other items I send my students is theirs "for keeps." You may use this equipment in your Radio and Television service work and save many dollars by not having to buy expensive "ready-made" test equipment. Each of my 8 kits will help you advance and learn important steps in Radio and Television servicing.

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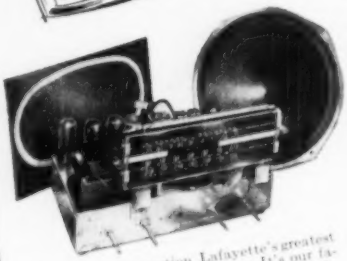

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Within the INDUSTRY

DR. HARRY F. OLSON, Director of the Acoustical Research Laboratory of *RCA Laboratories*, was recently awarded the first John H. Potts Memorial Award from the Audio Engineering Society.

Dr. Olson, a leading authority on acoustics, pioneered in the research and development of directional microphones, including the velocity type. He was also responsible for the development of a large variety of loudspeakers, the first successful electronic phonograph pickup, and a radically different sound absorber.

He has been associated with *RCA* since 1928.

* * *

HOWARD W. SAMS & CO., INC. has moved to its new plant located at 2201 East 46th Street, in Indianapolis. The new building has 30,000 square feet of space and houses all of the operations of the company which were formerly divided between four locations. . . . **THE A A WIRE PRODUCTS COMPANY** has announced that its offices are now located in its newly enlarged and modernized plant at 5401 S. Knox Avenue in Chicago. . . . **BURLINGAME ASSOCIATES** and its affiliate, **BRUJAC ELECTRONICS CORPORATION,** has moved to larger quarters at 103 Lafayette Street, New York 13, N. Y. . . . **THE ROBERT DOLLAR CO.** has opened a new H-K Gammatron Tube Division at 947 Broadway in Redwood City, California. The new plant manufactures gammatron tubes for commercial radio transmitting, television transmitting, and allied uses. . . . Additional factory space, totaling 10,000 square feet, has been acquired by **INSULINE CORPORATION OF AMERICA** in Long Island City. The new space will increase the capacity of the firm's present four-story building at 3602 35th Avenue. . . . **RAYTHEON MANUFACTURING COMPANY** has had to enlarge its Power Tube Division Plant at Waltham, Massachusetts in order to handle the increased demand for cathode-ray tubes. The new two-story addition will increase the floor space of the Waltham plant to approximately 145,000 square feet. . . . **RADIO ENGINEERING LABORATORIES** has consolidated all of its operations into the company's main plant at 36-40 37th Street, Long Island City 1, New York. The general offices as well as the manufacturing facilities will be located at the same address. . . . **MID-STATES WELDER MFG. CO.** has moved into its new offices and factory building at 6025 S. Ashland Avenue in Chicago. . . . **GATES RADIO COMPANY** of Quincy, Illinois has opened a new southeastern factory branch at 2700 Polk Avenue, Houston, Texas. . . . **MARS TELEVISION INC.** of Long Island City, in an expansion move, has relocated its assembly plant in larger quarters at 112-33 Colonial Avenue, Corona, New York. The new plant will enable the company to double production.

* * *

RADIO MANUFACTURERS ASSOCIATION has set up a new industry committee composed of both RMA members and non-member companies to develop further plans for the educational "Town Meetings" of television dealers.

A. T. Alexander of *Motorola Inc.*, chairman of the RMA Service Committee, was named chairman of the new committee. Companies to be represented on the committee by executives of the sales, advertising, accounting, and service departments include *Admiral, DuMont, Emerson, General Electric, Motorola, Philco, RCA, Stromberg-Carlson,* and *Zenith*. Chairman Stanley H. Manson of the RMA Advertising Committee will also serve on the committee.

Original plans for the television dealers' meetings proposed TV distributor-dealer meetings in 60 principal cities for the presentation of four 20-minute films on major subjects to assist dealers. The new committee will further study these plans with a view toward developing a more definite program to be underwritten by the set manufacturers in cooperation with distributors.

* * *

FRED W. PIPER has been named to head a new division at *Starrett Television Corporation*. The new unit will provide the company's "Opticlear" television sets for various veteran, social, and educational organizations.

Mr. Piper will contact local posts of veteran organizations, as well as social and religious organizations, and will arrange to have sets provided for various social meetings and functions. He will work directly with *Starrett* dealers in the different communities in arranging for sets to be installed and operated during the meetings.

Mr. Piper has been associated with the radio industry in various capacities for over 25 years. He was formerly a member of the *Amplion Corp. of*

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* * *

H. P. BALDERSON, sales manager for *Thermador Electrical Mfg. Company's* transformer division, has been named chairman of the Los Angeles Council of the West Coast Electronics Manufacturers Association.

Serving with Mr. Balderson in 1950 are C. A. Swanson, manager of *Standard Coil Products Co., Inc.,* as vice-chairman; and Fred W. Falck, Jr., general manager of *Advance Electric and Relay Co.,* who was reelected to the post of secretary-treasurer.

The 1950 board of directors includes, in addition to the officers, Robert Newcomb, president of *Newcomb Audio Products Co.;* E. P. Gertsch, president of *Gertsch Products, Inc.;* Wilbur V. Phillips, personnel director of *Hoffman Radio Corp.;* and Richard G. Leitner, chief engineer for *Lear of California, Inc.*

* * *

DAVID T. SCHULTZ, vice-president and treasurer of *Raytheon Manufacturing Company* since 1928, has been named to the board of directors of the company.

He joined *Raytheon's* predecessor company in 1927 as treasurer and has been associated with *Raytheon* since its inception in 1928. Mr. Schultz is also a director of *Metals & Controls Inc.* and has served the radio industry in the capacities of director and vice-president of the Radio Manufacturers Association.

* * *

RICHARD F. DOOLEY, FRANK J. KAZDA, CY S. ROSSATE, and **KENNETH D. TURNER** have been appointed vice-presidents of real estate, purchasing, production, and engineering respectively by *Admiral Corporation.* . . . The appointment of **F. P. TAUGHER** as manager of engineering for the Industrial Control Division has been announced by *Westinghouse Electric Corporation.* . . . **ROBERT J. MC DONALD** has been named district sales manager for *The Magnavox Company.* He will headquarter in Philadelphia and cover eastern Pennsylvania, Southern New Jersey, and Delaware. . . . **LARRY F. HARDY** is the new president of the Television and Radio Division of *Philco Corporation.* He will be in charge of all phases of the corporation's radio and TV business. **FREDERICK D. OGILBY** is the new vice-president in charge of sales for the same division. . . . **WESLEY L. WILSON** has taken over as general sales manager of the Cathode-Ray Tube Division of *Arcturus Electronics, Inc.* of Newark. . . . **JOHN D. SMALL** is the new executive assistant to the president of *Emerson Radio and Phonograph Corporation.* . . . **JOHN A. HICKEY** has been named engineering field adviser in the *Raytheon* Replace-

(*Continued on page* 128)

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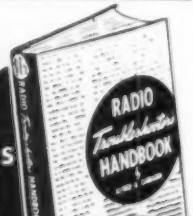

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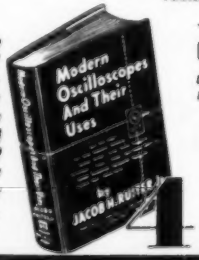

4

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PROCESSING RADIO TRANSCRIPTIONS

By
J. DALE HEALY

Silverplating the "master" recording.

1

Most of your favorite radio programs are now coming to you transcribed—here is how the discs are processed.

THE processing and manufacturing steps necessary to produce a phonograph record or an electrical transcription are so fascinating and so little known outside a tight little industry, that this article should prove of great interest to even the casual reader.

The author has tried to capture in visual form what would be most difficult to describe in non-technical language, and hopes that the combination of words and pictures will give continuity and form to a most delicate series of operations.

At the start, it should be pointed out that the tolerances permitted are fantastically small—so small in fact that no mechanical measuring equipment can record them.

When dealing with the physical reproduction of a 10,000 cycle tone, the permissible variation is limited to perhaps only one millionth of an inch! This can be measured only by playing the groove and measuring the electrical output through the most critically balanced circuits.

Measurements that in other industries would occupy the attention of laboratory technicians for hours, are made in minutes by use of specialized equipment. Hundreds of such measurements are made daily and plotted to indicate the over-all condition of the recording and processing departments. It is meticulous attention to minutiae that raises the quality of the transcription so far above the standards of three years ago, or even of the commercial phonograph of today.

The following sequence is used to maintain dimensional tolerances, frequency response, and fidelity.

Before the final vinylite pressing is produced, thirty-six basic manufacturing steps must be completed, each phase of which requires extreme care and strict compliance with detailed procedure.

The original, or "master" recording on lacquer, (the trade still refers to it as a "wax") has inscribed upon its surface minute sound modulations as picked up by the microphone from within the studio.

To make a number of copies of this original, the "master" recording is sent to a processing plant for the generation of metal parts which are an exact reproduction of the original "master" recording.

When the "master" recording is received at the processing plant, a code or serial number is assigned to it. This number is inscribed on the surface near the label area, and for all future reference identifies this particular recording.

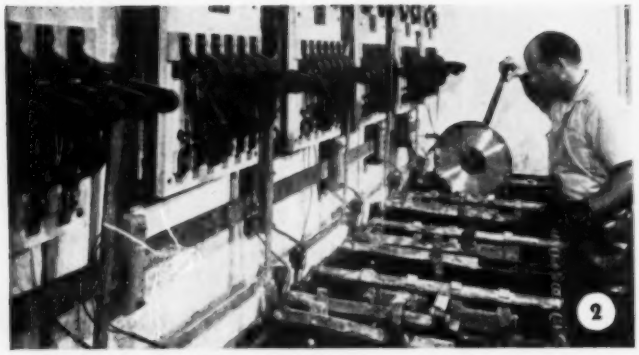
Having been received and coded, it is sent to the matrix department where it receives visual inspection, and in some cases microscopic inspection, before being released to processing.

Once it is released to processing, it goes to a temperature controlled silvering room, where the operator, prior to silvering, cleans the surface with a detergent and copious rinses of distilled water.

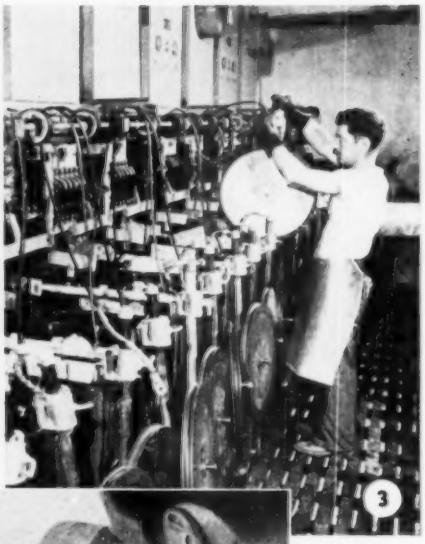
The surface is then sensitized by the application of a stannous chloride solution. This application assures the proper adherence of the deposited silver to all the minute detail of recorded groove and surface.

After sensitizing, the "master" is rinsed with distilled water and placed in a rubber tray. A chemical silver solution is now poured on the surface as shown in Fig. 1, and is rocked and agitated by the operator for approximately one minute during the precipitation of the silver solution. A film of metallic silver, "millionths" of an inch thick, is deposited on the surface of the "master" recording, thus making the surface a conductor of electric current. In its original state the surface was non-conducting and electrodeposition could not be accomplished.

Now that the "master" is silvered it can be placed in an acid copper plating tank to begin the first step in the generation of metal duplicate parts. See Fig. 2. The copper plating adheres to the thin film of silver and exactly conforms to every characteristic of the original master recording.



The acid copper plating operation known as the copper preplate bath.

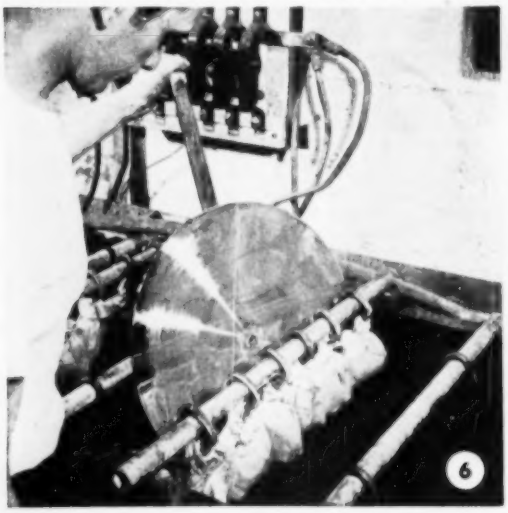


Copper plating on a revolving hanger to insure even plating in a very active copper plating solution bath.

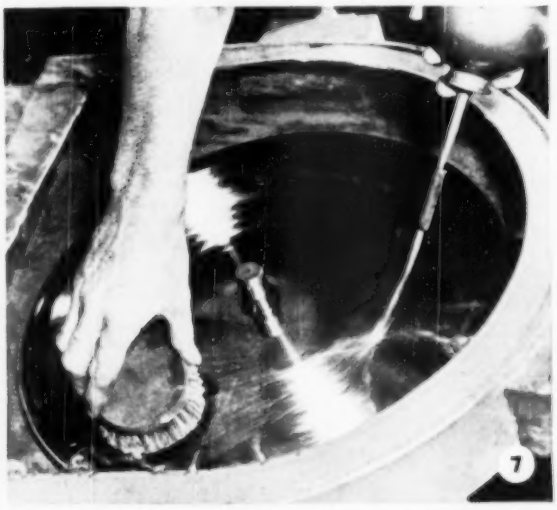
Stripping the metal "master" from the "master" recording.

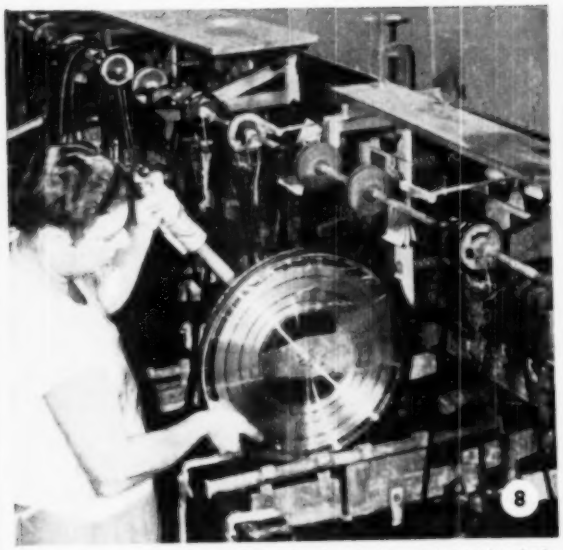
Centering to within .003 inch and center punching the "master."

The nickel plating operation which forms a protective surface.



The "master" is cleaned with naphtha while revolving on a spindle.





Metal "master," upon which a "mother" is formed, lowered in bath.

Technician making sound test of the metal "mother" recording.

After approximately 8 hours of copper plating, a plate of .032" of copper has been deposited on the face of the silvered "master" recording. It now has enough strength so that it can be safely separated from the "master" recording without danger of bending or damage. Fig. 4 shows the metal "master" being separated from the "master" recording.

We now have the first of our electro-formed metal parts which is a true "negative" of the original recording. All of the infinite detail of the original sound pattern has been faithfully reproduced in a new medium—the metal "master."

The metal "master," after separation, goes to the finishing room where it is re-centered to within ± .003". This operation is accomplished on a punch press by means of a dial indicator, as shown in Fig. 5.

Having been re-centered and punched, the metal "master" is electro-cleaned in preparation for a nickel facing plate that will form a protective film of nickel on its surface as shown in Fig. 6.

After nickel facing, the "master" is again cleaned by means of a spinning wheel and naphtha solution as shown in Fig. 7.

Our first metal part, the "*master*," has now been finished to the point where it is ready to serve as the original (negative) in another electro-forming cycle that will produce a second part, called the metal "*mother*."

In order that copper can now be deposited upon the nickel surface of the "master," to form the next part a molecular film of oxide must be provided on the "master" that will allow the new copper to conform intimately to all detail and yet be free from bonding to the nickel surface.

This oxide film is developed chemically by the application of a dichromate solution to the surface of the "master" which makes the nickel passive. Now that the nickeled surface has been oxidized, the metal "master" is mounted on a plating hanger and immersed in the acid copper tank to begin the formative stage of the second metal part, the "*mother*," Fig. 8.

After approximately 10 hours of plating time, we have the first metal part, or "master," on the face of which has been electro-formed the second metal part—the "mother."

Because the copper has formed around the edge of these plates it has to be filed away until a pry tool can be inserted at the edge to separate the two parts as was done with the original and metal "master" shown in Fig. 4.

Craftsman repairing a defective groove on the metal "mother."

Having started this electro-forming cycle with the metal "master," which is our "negative," we have now formed the "mother" which is a "positive"; identical in all respects to the original "master" recording except that we now have a "positive" in copper instead of the "wax" or lacquer positive we started with.

The "mother," being a positive, can be played the same

The surface of the "stamper" being hardened by chrome plating.

"Stamper" is punched and sheared to fit die of the record press.

as could the original recording. And by playing it we can determine exactly the faithfulness with which we have reproduced the sounds picked up by the microphone—electrically transcribed to the "master" recording, and finally reproduced in copper metal.

The "mother" is not only checked for tone quality, but also for signal-to-noise ratio and distortion. This test is shown in Fig. 9.

The term "mother" was no doubt applied to this second metal part because from it we can electro-form a number of "stamper" plates, which when mounted in the record press die, will produce mass quantities of vinylite pressings identical to the "mother" and the original "master" lacquer or "wax" recording.

If at any time in the handling of these metal parts they are unavoidably damaged, a skillful repairman with the proper tools and a basic knowledge of groove contour can repair the damage so that the untrained ear has difficulty in detecting the repair. A good example of the technique of repair is shown in Fig. 10.

The "mother," having passed sound inspection, is now nickeled and its surface prepared for the generation of the third metal part, the "*stamper*."

The "stamper" is electro-formed upon the face of the "mother" by the same method used in making the "mother" from the "master."

After plating in the acid copper the "stamper" is separated from the "mother," as described before in the case of "master" and "mother," and is sent to the finishing room for proper dimensioning before being mounted into the record press die.

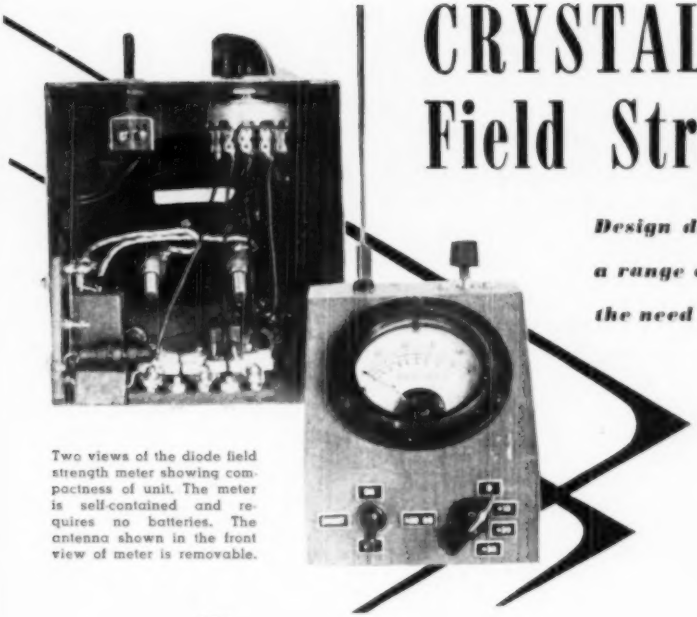
One operation of "stamper finishing" is the plating of a hard chromium film, Fig. 11, upon the face of the

(*Continued on page* 108)

The heat and high pressure of the stamping machine form the transcription from either special plastic or shellac material.

CRYSTAL DIODE Field Strength Meter

Design details of a compact unit having a range of 46 db. Crystal diodes obviate the need for a power supply or batteries.



Two views of the diode field strength meter showing compactness of unit. The meter is self-contained and requires no batteries. The antenna shown in the front view of meter is removable.

By

ROBERT C. MOSES

Sylvania Electric Products Inc.

IN THE development of an antenna system, one instrument above all others serves, when properly used, to give a true representation of the performance of the radiator. Particularly when applied to the design of a new antenna, a well-designed field strength meter will indicate when the optimum tuning adjustments and generally best performance have been achieved, and may also show directly the comparison of one system to another.

In the past, a great many types of field strength meters have been devised. One of the more widely used types consists of a vacuum-tube grid leak or bias detector with a suitably calibrated current meter in its plate circuit. This type of instrument is characterized by high sensitivity and an approximately logarithmic meter scale calibration, and in general is useful over a dynamic range of about 20 db. One problem, however, which is common to all types of vacuum tube field strength meters, is that of obtaining a suitable power source for the instrument. From the very nature of the device, portability and compactness are prime requirements, and since the instrument will, in general, be used remote from a source of a.c. power, batteries, with their many shortcomings, are inevitably required.

In order to overcome this inherent disadvantage, several crystal diode field strength meter designs have recently made their appearance. While these effectively eliminate the need for batteries and lend themselves to the design of extremely compact instruments, in general the sensitivity of such instruments is quite low. This limitation may require a relatively long pickup antenna particularly at the lower frequencies, or the placement of the instrument quite close to the radiating system under measurement, where, it is generally conceded, the accuracy of the indication may not be all that is desired. This article describes a crystal diode field strength meter of extreme compactness, requiring no batteries, and whose sensitivity is considerably above that of other instruments of this type.

Circuit Description

The circuit of the high-sensitivity crystal diode field strength meter is shown in Fig. 1. The r.f. detector and indicator portions of the instrument consist of paralleled pairs of type 1N34 germanium diodes together with condensers C_{12} and C_{13}, and the meter, M_1. The tuned input circuit C_1-L_1, by virtue of its effective "Q" of approximately 30, provides a useful voltage step-up,

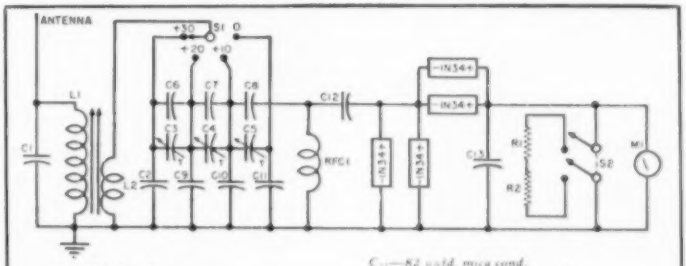
(*Continued on page* 136)

Table 1. Winding data for various ranges.

RANGE	L_1	L_2	C_1
3.5-4 mc.	32 t. closewound	14 t. closewound	120 $\mu\mu$fd.
7-7.3 mc.	18 t., $\frac{3}{4}$"	9 t. closewound	120 $\mu\mu$fd.
14-14.4 mc.	10 t., $\frac{3}{4}$"	6 t. closewound	82 $\mu\mu$fd.
27-30 mc.	6 t., $\frac{3}{4}$"	3 t. closewound	68 $\mu\mu$fd.

All coils are wound with #24 enameled wire on $\frac{1}{2}$" diameter slug-tuned forms. The coupling coils, L_2, should be wound on loose fitting sleeves slipped over the forms so that accurate adjustment of the spacing between the coils may be made aft r the unit is assembled. Such adjustment of the coupling is required in order to assure maximum transfer of energy through the input circuit. In practice, the coupling is set for maximum meter deflection with a steady signal applied to the antenna terminal through a resistor of the order of 20,000 ohms, and the tuned circuit carefully peaked at the signal frequency.

Fig. 1. Circuit diagram of the highly sensitive crystal diode field strength meter.



R_1—150 ohms, $\frac{1}{2}$ w. res.
R_2—24 ohm, $\frac{1}{2}$ w. res.
C_1—See Table 1
C_2—47 $\mu\mu$fd. mica cond.
C_3, C_4, C_5—3-30 $\mu\mu$fd. ceramic trimmer
C_6, C_7, C_8—22 $\mu\mu$fd. mica cond.
C_9, C_{10}—68 $\mu\mu$fd. mica cond.
C_{11}—82 $\mu\mu$fd. mica cond.
C_{12}, C_{13}—1800 $\mu\mu$fd. mica cond.
L_1, L_2—See Table 1
RFC—1 mh. r.f. choke
M_1—50 μa. d.c. meter (1100 ohms)
S_1—S.p. 4-pos. rotary sw.
S_2—D.p.s.t. toggle sw.
4—1N34 crystal diodes

ULTRA-MODERN WOR-TV Is 84th Television Station

New York's newest television station incorporates many interesting equipment and studio features.

By
NEWLAND SMITH
WOR-TV Video Facilities Engr.

WOR-TV, Channel 9, which has just gone on the air in New York, is the final station authorized for that area under present FCC v.h.f. allocations.

But WOR engineers have literally been in television ever since the new medium was first developed. They have kept abreast of the progress of the industry, watched new methods and equipment replace old. When WOR was granted a construction permit for WOR-TV, the engineering staff knew from their own experience, and from the good and bad experiences of engineers at other stations, exactly what camera pick-up and transmitting equipment would best enable them to build the most modern TV station in the area.

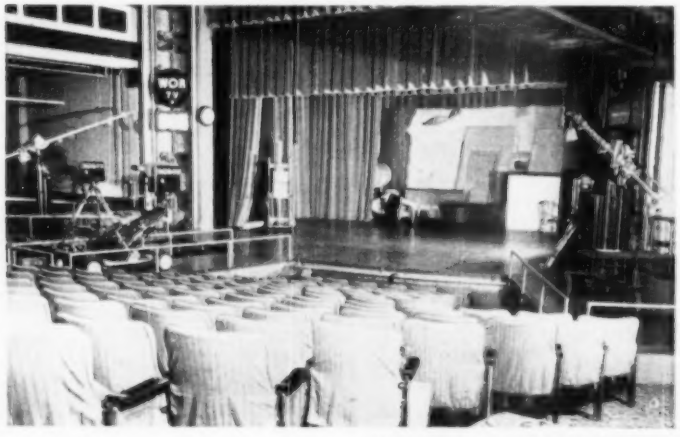
They chose their equipment from what they considered the best offered by the three leading manufacturers. This article will discuss the function and type of equipment used in each of three locations—the WOR-TV transmitter, studios, and mobile units.

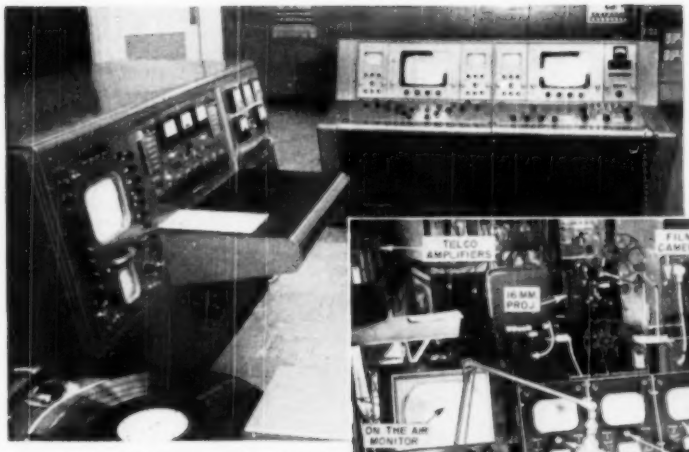
A 760-foot self-supporting tower holds WOR-TV's 50-foot transmitting antenna high in the air. The antenna is a six-bay superturnstile that radiates both audio and video carriers. The tower and antenna are located on the Palisades of New Jersey overlooking Manhattan, 240 feet above the Hudson River. Thus the combined height of the tower and antenna is 1050 feet above sea level.

Also located atop the tower is an FM antenna—a *GE* "doughnut" model, a special form of folded dipole. Because it is the belief of the station that both AM and FM radio will continue to co-exist with TV for some time to come, it was decided to integrate FM transmitting facilities with the TV installation. AM broadcasting facilities —without the problems of propagation affecting FM and TV—are satisfactorily supplied by WOR's existing

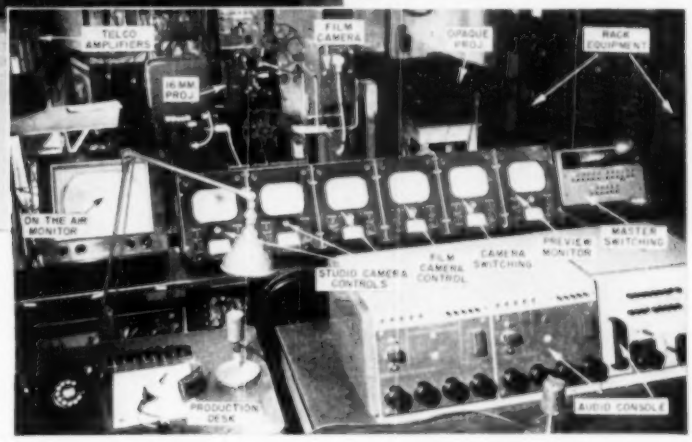
WOR's television transmitting tower located in North Bergen, N. J. 760 feet high, the tower is the tallest structure in the state. It stands 1050 feet above the Hudson River on the Palisades. From the 50-foot antenna, WOR-TV began operation on a 20-hour-a-week schedule on October 11th, telecasting on Channel 9.

WOR-TV's audience studio theater. In adapting the theater for television use, the orchestra pit was covered and three camera ramps added to the stage at the theater.





← Close up of transmitter control console (left) and video console (right, center). The turntable in foreground belongs to sound desk. The video mixing desk operator faces the TV and audio racks which line wall behind the console in right center. Instruments enable operators to set and maintain proper audio and video levels of the signals feeding into the transmitter unit.



↓ A studio control room at the New Amsterdam Roof Theater with the temporary master control switching setup now being used.

transmitter in Carteret, New Jersey.

FM and TV antennas are both equipped with heating devices to prevent formation of ice in the winter. This is important, since icing would change their transmission characteristics.

Located at the WOR-TV transmitter site, in addition to the television transmitter, are input video equipment for monitoring and handling incoming signals from the master control in the city, a microwave receiving terminal, and also a local source of video for generating the test pattern and transmitting slides.

The WOR-TV transmitter building has been designed for efficient operation. When seated at the transmitter control desk the operator on duty faces the transmitter unit, the racks of which line the walls at the right of the picture on this page. Both the sound desk and the camera control and mixer desks are easily available to him. Normally, however, the programs are originated elsewhere and routed to the transmitter via a master control point.

The master control was first located in WOR-TV studios in the New Amsterdam Roof Theater in New York. When studio facilities are completed in the Television Center at 67th Street in Manhattan, the master control will be located there.

The WOR-TV transmitter is a *General Electric* type TT6D rated at 5 kw. peak video power and 2.5 kw. aural power. Because of the present FCC 50 kw. e.r.p. (effective radiated power) limit, only 2.04 kw. is fed into the transmission lines.

The FM transmitter is a 10 kw. *GE* BT-4-B model.

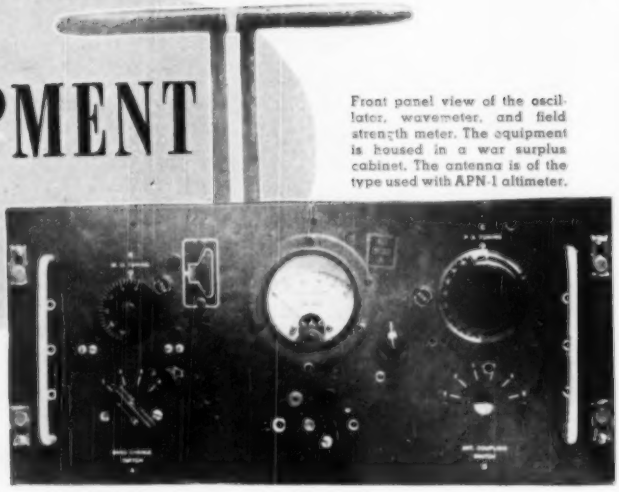
At this writing WOR-TV is originating its television programs from two studios and two associated control booths in the New Amsterdam Roof

(*Continued on page* 148)

Passageway behind the FM and TV transmitter racks. Nearest racks house the television transmitter with diplexer mounted above. The other racks contain the FM transmitter. In the left foreground is the dummy antenna while above it are the dehydrators for automatically pressurizing the transmission lines. Racks in background contain telephone terminal equipment (audio and video) and test and measuring equipment.

Interior view of power cubicle of FM transmitter showing rectifiers and transformers.

TEST EQUIPMENT For Citizens Radio



Front panel view of the oscillator, wavemeter, and field strength meter. The equipment is housed in a war surplus cabinet. The antenna is of the type used with APN-1 altimeter.

By **HAROLD B. McKAY**
Electronic Consultant

Complete details on the design of a wavemeter and field strength meter for u.h.f. band, and a 460-470 mc. oscillator which can be used as a signal generator.

ONE of the most important tools required in the testing of radio transmitters is a receiving device of good stability which is completely independent of the transmitter being tested.

For frequencies in the citizens band, 460 to 470 megacycles, there is no low-priced test equipment presently being manufactured. However, by using certain equipment which is still available as surplus, a useful wavemeter can be readily constructed.

This device will serve as an indication of transmitter frequency, field strength of the radiated signal, and as a crystal detector receiver for checking modulation quality.

The unit consists of a surplus butterfly condenser (300 to 1000 mc.), a diode crystal detector, and a microammeter.

Some of the surplus butterfly condensers are available with a crystal mounting and a bypass condenser built in the unit, which simplifies construction. In any event, a crystal of the 1N21 or similar type may be readily connected as shown in the diagram.

The bypass condenser shown in the drawing may be any small value ceramic or mica unit. It is necessary to use this bypass condenser only if none is built into the butterfly condenser.

The butterfly condenser has an extremely wide tuning range. While this makes it unreliable for precise frequency measurements, it has the advantage of tuning to the second harmonic of the citizens frequency, which is an important consideration in transmitter adjustment.

The tuning unit is coupled to a dipole antenna by means of a short length of 52-ohm coaxial cable. A coaxial chassis-type connector mounted on the butterfly receives the cable. The lead from the coax connector to the condenser frame terminates in a small loop, L_1, to give slight coupling.

The antenna is the type used with the APN-1 altimeter. The large diameter of the radiating elements broadens its range. The stand-off supports hold the antenna at one-quarter wavelength from the cabinet. This is useful in field strength measurements, as it reinforces the signal uniformly and eliminates stray reflections from other objects when the antenna is held vertically.

The meter used in this model is a 0-50 microammeter though less sensitive instruments may be used with reduced range. Protective resistors are connected across the meter by means of a switch. Two resistors of about one-half of the resistance of the meter serve as shunts, when working close to a strong signal.

The "off" position of the switch places a short across the meter.

The leads to the meter may be extended to pin jacks on the front panel where headphones may be connected to monitor the signal.

The cabinet housing the device is from a surplus transmitter tuning unit. It was chosen because of the two calibrated reduction-gear dials, which are the only parts of the original tuning unit used in this wavemeter.

To calibrate the wavemeter it is necessary to have a signal generator or transmitter, the signal from which can be received on the wavemeter. The frequency of the signal-generating device may be measured by Lecher lines, then the dial setting of the wavemeter noted. A calibration chart may be easily prepared in this manner for the wavemeter.

The wavemeter will not give sharp enough indications for frequency measurements as required by FCC, but is very useful for approximate adjustments.

In addition to its uses as a relative field strength meter, this device can also be placed near the transmitter during normal operation. It will function as an indication that the transmitter is on the air, and will indicate any large frequency drift which may occur.

Oscillator for 460-470 mc.

A useful accessory which can be added to the wavemeter described is an oscillator whose fundamental range is within the citizens radio band.

Such an oscillator may be built around a *Johnson* miniature butterfly

condenser. Ultra-high-frequency oscillators are in general somewhat unstable, and extremely sensitive to stray capacity effects.

The coil-condenser combination used in this circuit has been found to be less sensitive to these effects, because of the small size of the oscillating elements. In this respect it has an advantage over the tuned-line circuits usually used at these frequencies.

If placed in a comparatively large cabinet enclosure, the oscillator will be completely immune to body capacity effects, and may be readily tuned and handled. However, it will be sensitive to changes in the dimensions of the enclosure and the device must be handled in a manner which will not cause the sides of the cabinet to bend.

Ordinarily, when used as a signal generator, no antenna will be required, as the cabinet itself will radiate. However, if an antenna is used, it should be connected by a coupling loop, L_5, located at least an inch from the oscillator coil.

An antenna connected in this manner will not alter the frequency of the oscillator even if touched.

Considerable experimenting may be required in the construction of the oscillator in order to get the frequency to fall in the citizens band. The tuning range is very limited, covering only 8 to 10 megacycles.

This provides excellent bandspread for spotting exact frequencies in the band, but calls for a certain amount of trial and error in the construction of the tuned circuit.

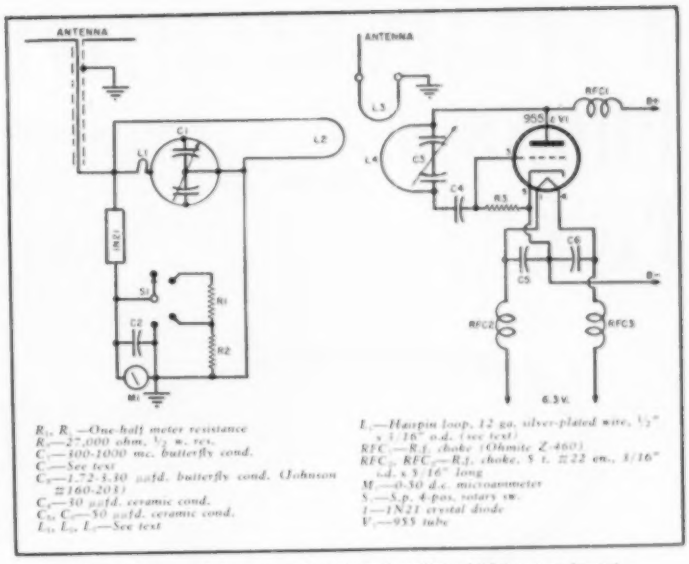
In the model shown, the "coil," L_4, is a "V" shaped piece of 12 gauge silver-plated wire, $\frac{1}{2}$"x$\frac{5}{16}$" outside diameter. It was made by bending the wire around the tip of a pair of long-nosed pliers, then adjusting it to just fit the gap between the stator posts on the butterfly condenser.

The frequency of this assembly may be changed slightly by squeezing or expanding the "V." The shape of the wire, as well as its size, are not definite quantities. The shape and size of the cabinet, the proximity of wiring or brackets, the value of the grid condenser, and numerous intangibles will affect the frequency of the oscillator.

It may, therefore, be necessary to prepare several "V" and "U" shaped pieces of wire or copper strip with which to experiment. While a wide range of wire sizes may be used, No. 12 or 14 is best because it remains rigid. Silver plating is not necessary, but will increase efficiency.

In testing different sizes of loops, the wire should be shortened to raise the frequency and lengthened to lower it. Experiments may start with a wire about an inch long. This may be gradually trimmed down until the frequency falls in the required range.

Occasionally, as the loop is reduced, the circuit may fail to oscillate. For this reason, a 0-25 milliammeter should be kept in the plate supply lead while adjustments are being made. A reading of about 7 milliamperes indicates oscillation. Ten or higher means oscillations have ceased.



R_1, R_2—One-half meter resistance
R_3—2",000 ohm, ½ w. res.
C_1—100-1000 mc. butterfly cond.
C_2—See text
C_3—1.72-5.80 μμfd. butterfly cond. (Johnson #160-203)
C_4—50 μμfd. ceramic cond.
C_5, C_6—50 μμfd. ceramic cond.
L_1, L_2, L_3—See text
L_4—Hairpin loop, 12 ga. silver-plated wire, ½" x 5/16" o.d. (see text)
RFC—R.f. choke (Ohmite Z-460)
RFC$_2$, RFC$_3$—R.f. choke, 5 t. #22 en., 3/16" o.d. x 5/16" long
M—0-50 d.c. microammeter
S—S.p. 4-pos. rotary sw.
1—1N21 crystal diode
V—955 tube

Circuit diagram of the wavemeter (left) and oscillator (right) test equipment.

Should the oscillator fail, it may be necessary to change the value of the grid condenser. Past experiments have indicated that the final value may fall anywhere between 15 and 50 μμfd.

It will be noted that the circuit shown omits a connection to the condenser rotor, and has no plate circuit bypass condenser. This is intentional and the oscillator has been found to work best with the circuit shown. This simplifies construction and improves stability, as every condenser in the circuit affects the frequency.

In some cases failure of the oscillator to function may be caused by the r.f. chokes used in the plate and heater leads. If the oscillator failure can not be definitely traced to other causes, some experimentation with the chokes is indicated. Due to the many varying factors, the optimum size and number of turns will have to be determined by experiment. The values given will serve as a starter.

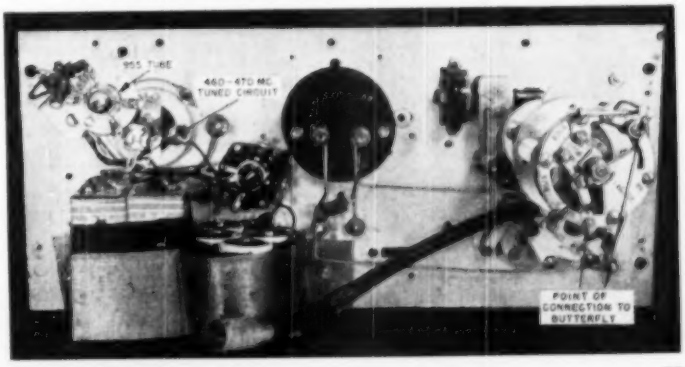
If this device is used in conjunction with the wavemeter, a pick-up loop, L_5, made of any piece of stiff wire, may be used to integrate the two units, so that one may be checked against the other.

The oscillator described may be operated from any power supply. However, leads to an external power supply may be sensitive to body-capacity effects unless bypassed effectively.

A better arrangement is a self-contained pack composed of two 67½ volt Minimax batteries and five flashlight cells. Five cells are used because the voltage drop caused by the tube current brings the net voltage down to about six and one-half volts.

—30—

Rear panel view showing how components are mounted direct to the panel.



A STRAIN-SENSITIVE PHONO PICKUP

A close-up view of the new pickup. It is a carbon type with a resistance of 250,000 ohms and an output of 10-15 mv.

By R. S. JOHN
Pfanstiehl Chemical Co.

Details of an amplitude type transducer which exhibits a linear characteristic.

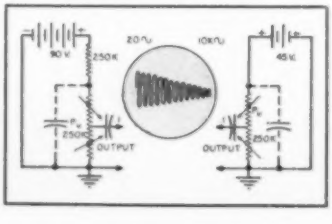
THE search for quality and the natural, distortion-free reproduction of music and sound is a never-ending one. When it is made by way of phonograph records, present technical thinking puts its finger of suspicion on the ends of the chain, namely on the pickup and the speaker. The next most suspected link is the preamplifier. There is good reason to believe that amplifiers can be made to a high degree of perfection.

The function of the pickup is to take the mechanical energy supplied by the record, in conjunction with the turntable drive, and transform this energy pattern into an electrical energy image. Many a pitfall lies right at this point in the shape of the groove of the record, the record material, its linear speed under the needle, the shape of the needle tip together with its force on the record, the compliance of the pickup and in many other factors which have been discussed extensively in the technical literature. While much could be said about these things, they all add up to the degree of perfection with which the stylus is coupled dynamically to the groove. If we can assume, for the sake of making progress in our query, that this coupling is as perfect as possible, the picture broadens out to considerations of depth of cut, line spacing, and recording characteristic of the record—and inherent response characteristics of the pickup.

The different turnover points used in record cutting are well known. The amplitude of the groove swing below this point is constant, but it tapers to smaller excursions in the higher frequency range. The graphical representation of the cutting characteristic above the turnover point is almost a straight line, or one rising toward the higher frequency. This rise or the emphasis in the treble is almost as familiar to the music quality fans as the knowledge of the turnover point.

The pickup that plays the record will be either a velocity or an amplitude type transducer. Crystal pickups are approximately amplitude types. The departure from true amplitude response is created by the damping and coupling schemes necessary in the mounting of the crystal in the cartridge. An additional departure from amplitude response is caused by the mechanical impedance of the stylus chuck and stylus itself. A velocity type dynamic or variable reluctance pickup falls off in bass response because of the reduced "velocity" in the recording of bass tones. The response of this same type of pickup will also fall off in the treble because of the coil impedance increase with higher frequency—a varying impedance problem. A number of schemes have been employed in both types of pickups to improve the linearity of the type of response, some with considerable degrees of success but usually with reduced output. However, if the response of either type droops at either end of the frequency spectrum, a boost of some sort, obtained usually by an *RC* network, must be used to make the response flat and linear or shaped to fit a recording characteristic. The compensating network to correct a resonance is a similar problem but will not be discussed here.

Fig. 1. The circuit used when the pickup is polarized with a battery.



The principal trouble with boosting is that it is never linear and is not easy to shape so that it perfectly corrects a non-linear output with which it works. The combination of this non-linear boost and a non-linear output seldom has a linear result. For this reason a boosted tone does not sound as good and true as a natural one. It can be considered a source of distortion. However, a poorly boosted low tone often seems to be very acceptable to a noncritical listener.

The pickup to be described here is an amplitude type of transducer with a comparatively high output level and

a truly linear characteristic. If for the sake of experiment it is polarized by a battery, the response has been found to be uniform and undistorted to 20 cycles. This low frequency is easily obtained by running a *Clarkstan* 78 r.p.m., No. 1000 A, sweep frequency record at 33⅓ r.p.m. and observing the output on an oscilloscope. It will extend practically to 0 frequency, with rising output, if the mass of the cartridge and tone arm were to be increased, and a larger condenser used in the output.

The output of either circuit of Fig. 1 may be fed into a high gain amplifier if you want to listen. It is an uncorrected frequency response so the tone controls must be employed. Neither the scope nor the listening test will show any peaks or other evidence of distortion.

The pickup offers a very clean signal to the preamplifier that ordinarily is used with it. This preamplifier uses a degenerative bass feedback which decreases the bass response to the "flatness" desirable. A small amount of treble boost may actually be used but great care should be exercised in the 10,000 cycle region. It is near that frequency that most of the steady hissing type of surface noise from the record appears. Any decided boost in that region is apt to add to the over-all background noise, but some can be used if it is desired, and the signal level is high enough above that of any background component or tube noise.

It is common practice to turn a gain control up to a rather high level to have the music override the surface noise. There may be some justification for this practice where the high frequency output of the pickup is barely above the general noise level. When the treble output level of the pickup is high enough, a flat response to 10,000 cycles can be used on 78 r.p.m. records; and if the sound output level is moderate, the hearing characteristics of the ear will deceive one enough to eliminate all but a trace of surface noise. This moderate loudness level does need a relatively higher level bass for the natural fullness of the tone.

In reproducing music from records the operator and listeners should recognize the fact that the various 78 r.p.m. records can be just as different as people. There is a best way to play almost any record even if you can't find it! If one record, when played, sounds excellent and the next one far from it, don't be in too great a rush to condemn the record, the speaker, or some other component. The trouble may well include the operator. The people who know the most about the sound reproduction chain are the last to make a sweeping statement placing the blame on any one thing. Flat treble response may not be compatible with comfortable listening on some records.

A generally desirable output characteristic from the preamplifier is one having a steadily rising bass flare of about 6 db., starting at about 500 cycles and extending to 40 cycles or lower, depending on the amount of turntable rumble that may be tolerated. No adjustment need be made for turnover point—response patterns will vary only a few db. for various recording characteristics. The rest of the range has a 1 or 2 db. drop to about 8000 cycles, where an additional tapering drop of about 2 db. to 10,000 cycles is introduced. The actual response may extend to over 15,000 cycles. This type of response with a complete absence of peaks retains the brilliance of the music with the least amount of surface noise. Surface noise is least noticeable when the response curve is smooth and free from peaks. The extended high frequency range adds much to the realism of violin overtones, triangles, and cymbal crashes. But no wishful thinking can make you hear these sounds if they are not actually recorded. The lift in the bass permits satisfactory playing of records at lower levels. It applies an extra push to the speakers on low frequencies where they usually need help. The pickup will respond cleanly to well over 20,000 cycles when it is driven by an inverted recording head.

The active element of the pickup (Fig. 2A) being discussed is built up on a plastic rectangular cantilever beam, carrying the stylus near one end, and firmly held in the cartridge at the other end. The strain sensitive material, principally carbon, is coated

(*Continued on page* 124)

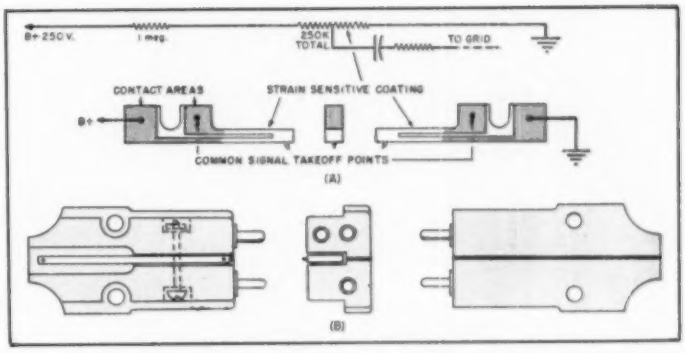


Fig. 2. (A) Active element with integral stylus. (B) Cartridge with strain sensitive element.

Output	10 to 15 mv.
Resistance	250,000 ohms
Weight	8.3 gr.
Stylus Pressure	
(78 r.p.m.)	15-20 gr.
(33 r.p.m.)	6 gr.
Compliance	9×10^{-6} cm./dyne
Noise level	nil
Hum pickup	nil
Distortion	none
Hangover	none
Phase distortion	none

Specifications on the strain sensitive pickup unit developed by Pfanstiehl.

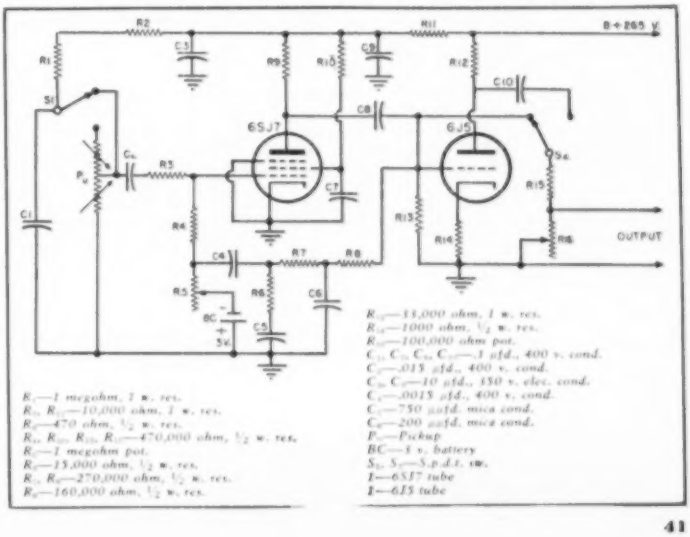


Fig. 3. Preamplifier used with pickup. Switch S_2 enables the pickup to be used either double or single sided. S_1 selects the single or two stage output of the preamplifier.

A Two-Band Piece of Wire

By KARL DREHER, WØWO

An easy-to-build, economical, highly efficient multi-band antenna for the amateur.

IN THIS era of multi-element rotary beams, stacked arrays, squashed cubicle quads, and other catch-named antennas, it may be reassuring to realize anew that a single-wire antenna properly connected to a receiver or transmitter still works well. The degree of its performance depends greatly upon how efficiently it is connected.

Being a more than one-band operator, the author some months ago dreamed and figured at considerable length on just how to feed a long, high-wire antenna so that it could be used on two or more harmonically-related bands, using a flat or untuned feed line, and still maintain efficient matching of feed line to both antenna and transmitter or receiver. One cold, early dawn the subconscious mind awakened the outer man, and several curves were hastily drawn, resulting in a very simple yet conclusive answer to how the problem could easily be resolved.

Perhaps at your amateur station location, you have some means of supporting in the clear a single piece of wire 68 feet long and would be interested in erecting in this available space a highly-efficient yet very simple antenna at but little cost. Or maybe you are starting from scratch and desire an effective sky-wire whose erection requires very little technical and structural knowhow and one that is inexpensive to build. If you fall in either of these categories or simply would like to try something a little different in the way of an antenna, then the one described herein should interest you.

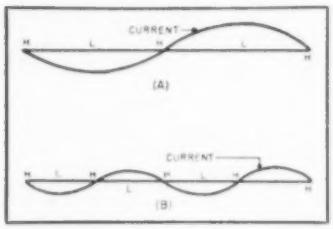
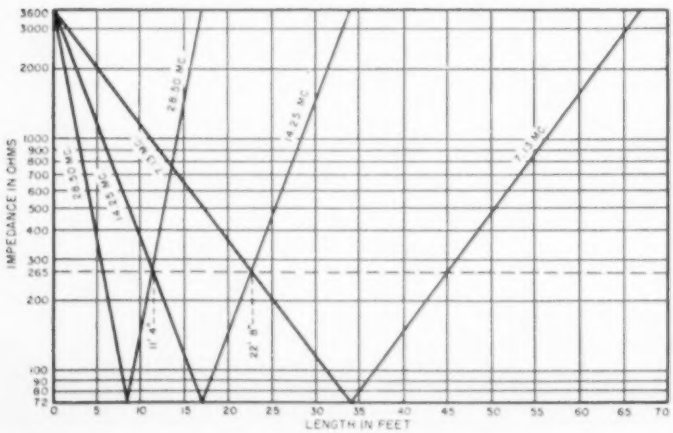


Fig. 1.

Fig. 2.



Theory

A piece of wire 68 feet long and in the clear will resonate at approximately two half-wavelengths on 14.25 mc. and four half-wavelengths on 28.50 mc., according to the accepted antenna formula. The characteristic cloverleaf horizontal pattern of radiation makes such a piece of wire desirable as a general coverage radiator. If such an antenna were fed with a non-resonant line, and no electrical adjustments to it or the antenna were required when tuning up or changing operating bands, then you would have the most simple and convenient antenna conceivable.

Such an arrangement becomes a reality when thoughtful consideration is given to well-known fundamental electrical characteristics of long-wire antennas and non-resonant feed lines. Fig. 1A depicts the current distribution on a 68-foot piece of open end wire operating at 14.25 mc., and Fig. 1B shows the current distribution at 28.50 mc. In any antenna a multiple of a half-wave in length, as in Figs. 1A and 1B, the impedance of the wire reaches its lowest value at each current loop (point L) and its highest where the current almost equals zero (point H). Theory and practice establish the fact that at the end, or high impedance point, the value is approximately 3600 ohms, and at the center, or low impedance point, approximately 72 ohms. Fig. 2 shows the values of impedance of a resonant half-wavelength of wire plotted against physical length. It is to be noted that the curves cross one another at a common point which corresponds to 265 ohms impedance at a distance of 11 feet, 4 inches from one end.

Accordingly, the conclusion is reached that a single piece of antenna wire 68 feet long can be fed 11 feet, 4 inches from one end by a 265 ohm, non-resonant feed line and operated on both 14.25 mc. and 28.50 mc. with perfect transfer of energy to the system. Because height above the ground and proximity of nearby objects affect the electrical characteristics of any antenna to some degree, the common impedance value of 265 ohms in the described system can be considered as 300 ohms for all practical purposes, and the 11 foot, 4 inch dimension shall be considered as 11 feet, even.

Construction

On that basis, the author cut a 68-foot piece of antenna wire 11 feet from one end and connected in series thereto a 300 ohm, twin-lead ribbon of random length, long enough to reach the operating position in the station. To provide a structurally and electrically sound means of making the connection of the feed line to the antenna,

(*Continued on page 70*)

Modern TELEVISION RECEIVERS

By MILTON S. KIVER

This well-equipped, home-made service bench was designed and built by L. Poirier of Quebec.

Part 22. A continuation of the discussion on automatic frequency control systems used in television receivers.

LAST month we investigated the operation of a sine-wave automatic frequency control system which utilized a reactance tube. Another approach to automatic frequency control of the horizontal sweep oscillator is the system shown in Fig. 1. A frequency discriminator, consisting of two diodes (V_{1A} and V_{1B}), receives a saw-tooth voltage from the horizontal sweep system and sync pulses from the incoming signal. The two voltages are compared as to frequency and any existing difference produces either a positive or negative voltage at the grid of V_2. These changes are amplified and then transferred to the multivibrator whose frequency is changed accordingly.

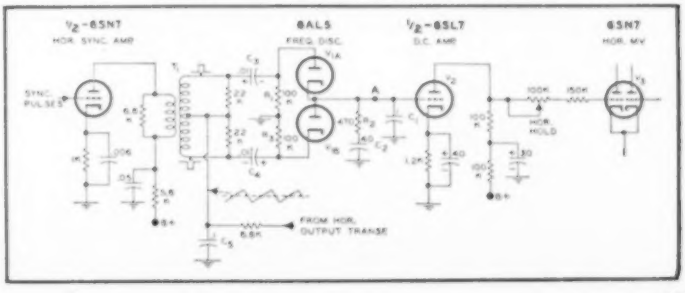
In detail, the automatic horizontal frequency control network functions as follows: The incoming horizontal sync pulses are transferred by means of T_1 to the two diodes, V_{1A} and V_{1B}, with the polarity as shown in Fig. 1. The top end of the secondary of T_1 develops a positive pulse voltage and the bottom end a negative pulse. The positive pulse causes V_{1A} to conduct, and the negative pulse at the cathode of V_{1B} causes this tube to conduct too. The current flowing through V_{1A} charges condenser C_3 to approximately the peak value of the applied pulse while the current flowing through V_{1B} charges C_4. The polarity of each voltage is indicated in Fig. 1. During the interval between pulses, each condenser discharges, the electrons moving from C_3 down through R_3 and R_4 to C_4 and from the other plate of C_4 through the secondary transformer winding back to C_3. The discharge is slow and the voltages developed across R_3 and R_4 prevent V_{1A} and V_{1B}, respectively, from conducting until the arrival of the next pulse.

Feeding into this same circuit is a saw-tooth voltage which is developed across C_1 from pulses which are applied to it from the secondary of the horizontal output transformer. The saw-tooth voltage possesses the same frequency as the horizontal sweep oscillator since the oscillator drives the horizontal output amplifier. The saw-tooth voltage is applied in equal measure to each tube; this means that the plate of V_{1A} and the cathode of V_{1B} receive the same polarity saw-tooth voltage at the same time. Thus, at the discriminator, we have all the ingredients needed to check the operating frequency of the horizontal oscillator against the frequency of the incoming pulses.

The comparison of the two frequencies occurs only at the instant the sync pulses arrive, for it is only at this moment that V_{1A} and V_{1B} conduct and therefore are in a position to respond to the saw-tooth voltage. As in the previous a.f.c. circuit, three situations are possible.

First, if the sync pulses arrive at a time when the saw-tooth wave is passing through zero, then current will flow through V_{1A} and V_{1B}, recharging C_3 and C_4 for any voltage that they may have lost during the interval between pulses. This flow of current will remain within the branch of the circuit formed by the two tubes and the secondary of T_1. No voltage will appear between point A and ground to

Fig. 1. A saw-tooth automatic frequency control system.



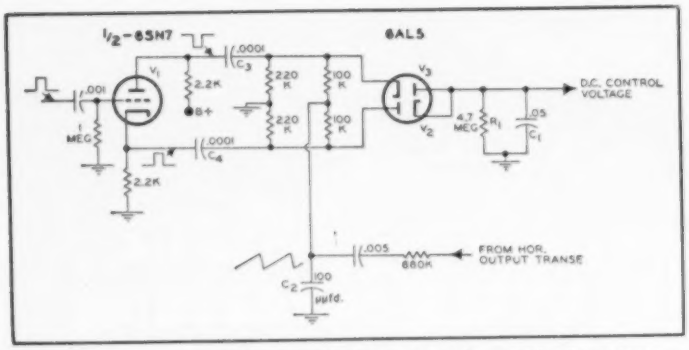


Fig. 2. A frequency discriminator that is widely used with saw-tooth a.f.c. systems.

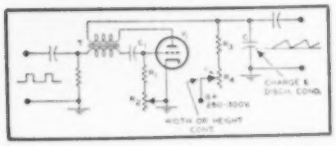


Fig. 3. The frequency of this sweep blocking oscillator is determined primarily by the values of components, C, R, and R.

affect the d.c. amplifier, V_3, and through this, the horizontal multivibrator. Actually this represents the desired condition since it indicates that the frequency of the sweep oscillator and the sync pulses are in step with each other.

The second situation arises when the sync pulses arrive and the saw-tooth voltage is positive at this moment. Under this condition V_{1A} will receive a positive pulse and a positive saw-tooth voltage. V_{1A} will conduct more strongly than usual, with current not only charging C_3, but also charging C_1 and C_2, since electrons are flowing from the region A through the cathode to plate of V_{1A}. This will establish a voltage at point A which is positive with respect to ground.

At the same moment that V_{1A} is conducting more strongly, conduction through V_{1B} is reduced because the positive saw-tooth voltage partially offsets the negative sync pulse applied to the cathode of V_{1B}. Since the current flow through V_{1B} is reduced instead of increased as it is through V_{1A}, it cannot offset the positive voltage at point A. This potential, applied to the grid of V_3, causes the current through V_3 to increase, driving the plate of this tube more negative. Since the grid of the horizontal multivibrator is connected to the plate of V_3, it, too, becomes more negative, thereby altering its frequency. In this instance, the change is toward a lower frequency.

The third situation occurs when the pulses arrive and the saw-tooth voltage is negative. Now, V_{1B} conducts more strongly than V_{1A}, its current flowing not only into C_3, charging it, but also charging C_1 and C_2, since electrons will flow from cathode to plate of V_{1B}, producing an excess of electrons and so a negative voltage at A. This reduces the current flow through V_3 and acts to speed up or raise the frequency of the horizontal multivibrator.

Filter R_3, C_4 and C_5 responds only to slow changes, thereby preventing fast acting noise pulses from affecting the operation of the multivibrator. A horizontal output amplifier receives the peaked deflection voltage from the multivibrator, amplifies it, and uses this voltage to drive a high-voltage rectifier (8016), and the horizontal deflection coils. A tuned circuit in the cathode leg of the multivibrator (not shown) is resonant to 15,750 cycles and serves to further stabilize the operation of this unit at this frequency.

D.C. Control of Oscillator Frequency. In the first a.f.c. system discussed, the d.c. control voltage from the discriminator was applied to a reactance tube and this, in turn, varied the sweep oscillator frequency. In the present a.f.c. system, the d.c. control voltage developed by the sync discriminator is used directly to alter the frequency of the horizontal sweep oscillator. This direct method of frequency control is readily adapted to multivibrators and blocking oscillators.

To understand what happens when the d.c. control voltage is applied directly to an oscillator, consider the operation of a blocking oscillator.

The length of time a blocking oscillator is cut off is determined primarily by the time constant of the grid circuit. See Fig. 3. When the grid resistor and condenser values are high, the charge accumulated across the grid condenser diminishes slowly and the tube is kept cut-off for a longer period of time. When the values of these components are low, the cut-off interval of the tube is shortened accordingly.

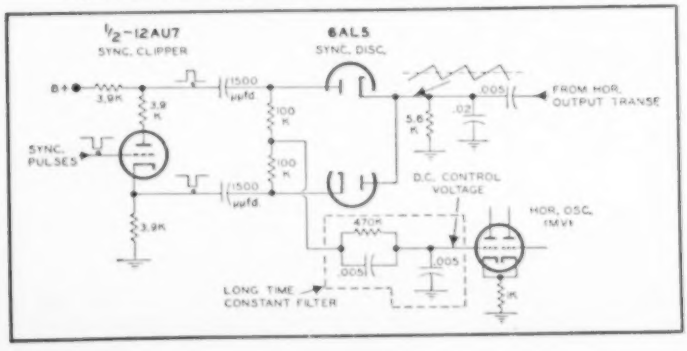
Now, if we raise the negative bias on the grid (by adding a negative voltage from some external source), then we can see that reaching the cut-off bias value of the tube, using the same grid resistors and condensers, will require a longer time than if no such negative voltage had been added to the circuit. And if the tube is kept cut off for a longer period of time, then obviously the frequency generated by this oscillator will be lower.

On the other hand, injecting a small positive voltage on the grid of the oscillator will decrease the total negative voltage developed here by the circuit operation and permit the tube to return to conduction sooner. The result: Generation of a higher frequency. It is precisely in this manner that the d.c. control voltage developed by this sync discriminator circuit varies the frequency of the sweep oscillator. While only the action of a blocking oscillator has been analyzed, the reasoning for a multivibrator is quite similar.

Circuit Variations. There are several variations of the foregoing saw-tooth a.f.c. circuit that find extensive use in current television receivers. One of these is shown in Fig. 2. The incoming sync pulses are fed, in equal amplitude but opposite polarity, to two diodes, V_1 and V_2. The plate of V_2 receives a positive horizontal sync pulse at the same time that the cathode of V_1 is receiving a negative sync pulse from V_3. Due to the polarity of these pulses, both diodes will conduct at this instant, with the current flowing around the circuit to charge the sync pulse coupling condensers, C_1 and C_2. The charge developed across each of these condensers will prevent V_1 or V_2 from conducting until the arrival of the next sync pulse.

In addition to the sync pulses, V_1 and V_2 also receive a saw-tooth voltage

Fig. 4. A variation of the automatic frequency control system shown in Fig. 2.



from the horizontal sweep amplifier. As in the previous system, the saw-tooth wave will be going through zero at the time the sync pulses reach V_2 and V_3 if the frequency of the horizontal sweep oscillator is properly synchronized to the incoming pulses. If a frequency difference exists, the saw-tooth voltage will not be going through zero when the sync pulses arrive. If the saw-tooth voltage has some negative value at this instant, V_3 will conduct more strongly than V_2 and a negative resultant voltage will appear across C_1 and R_1. (A negative saw-tooth voltage favors V_3 because this voltage is applied to the cathode of the tube.) The negative voltage across C_1 is then passed on to the following sweep oscillator, changing its point of operation and, consequently, its frequency.

By the same token, arrival of the sync pulses when the saw-tooth voltage is positive will cause V_2 to conduct more strongly than V_3, producing a resultant positive voltage across C_1. (A positive saw-tooth voltage favors V_2 because it is being applied to the plate of this tube.) The effect on the sweep oscillator of the positive voltage across C_1 will be opposite to that produced by a negative voltage.

C_1 and R_1 form a fairly long time-constant filter, permitting only the voltage variations due to differences between the frequency of the sync pulses and the saw-tooth voltage to develop here. Momentary voltage variations due to noise pulses are effectively suppressed.

The d.c. control voltage obtained from C_1 could be applied directly to the horizontal sweep oscillator and in some receivers, it is. On the other hand, a more sensitive arrangement is obtained when the d.c. control voltage is amplified before being applied to the horizontal oscillator.

Variations of this circuit, as used by such manufacturers as *Bendix, Emerson, Garod, General Electric, Hallicrafters, Tele-King, United States Television*, etc., consists primarily in the means of applying the saw-tooth voltage to the discriminator. The circuit shown in Fig. 2 represents one method; the circuit of Fig. 4 illustrates another approach. In either case, circuit operation is the same.

Troubleshooting Saw-Tooth A.F.C. Systems. Examination of the saw-tooth a.f.c. system will reveal that it contains no controls other than the horizontal hold control. In this respect it is superior to the previous sine wave system where there existed two additional controls besides the horizontal hold potentiometer. Due to the simplicity of the circuit, failure of the system to operate properly can only mean a defective component. With the aid of an oscilloscope, the two pulse voltages and the saw-tooth voltage reaching the frequency discriminator diodes can be readily checked. To determine whether a d.c. control voltage is being developed at the output of the discriminator, connect a vacuum-tube voltmeter across the output, between point *A* and ground of Fig. 1. Set the meter to the lowest voltage scale possible. Now slowly rotate the horizontal hold control. If the saw-tooth voltage reaching the discriminator is being received properly, the meter needle will move back and forth. By the same token, switching the set to an unused channel (generally this is the next one on most sets) will cause the meter reading to decrease. In some sets the meter reading will decrease to zero; in other sets some small voltage will remain in this portion of the circuit. If either of these indications (but not both) are absent, it indicates that the saw-tooth or pulse voltages are not reaching the discriminator diodes. If both indications are lacking, the trouble exists in the diode circuit itself.

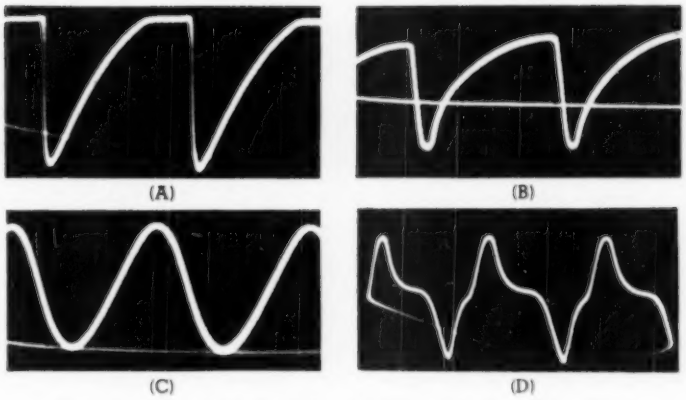


Fig. 5. Typical waveforms in the a.f.c. circuit of Fig. 6. (A) At pin 7 of V_1 (30 volts); (B) At pin 5 of V_1 (20 volts); (C) At control grid of V_1 (52 volts); and (D) At the input of the horizontal discharge tube (80 volts). All voltages are peak-to-peak.

Where d.c. amplifiers are inserted between the discriminator and the horizontal oscillator, the foregoing voltage variations should be checked in the grid and plate circuits of the d.c. amplifier tube. The variations in the plate circuit should be greater than those observed in the grid circuit.

The hold-in range of the horizontal hold control, when the system is operating properly, is slightly less than that experienced with sets employing the sine wave a.f.c. system. In most sets, if the hold control can be varied through an arc of 90 degrees without forcing the circuit to lose sync, then the set is operating normally. In common with the previous sine wave system, the hold-in range is greater than the pull-in range. This is most noticeable when the set is first turned on.

A final servicing point regarding this particular circuit is the criticalness, in some designs, of the resistor values in the plate circuit of the d.c. amplifier. If these change to any appreciable extent, it may be impossible to bring the oscillator into sync. Check the values of these resistances against their marked or stated value.

Combination A.F.C. System. There is a horizontal a.f.c. system in use which combines both the saw-tooth and the

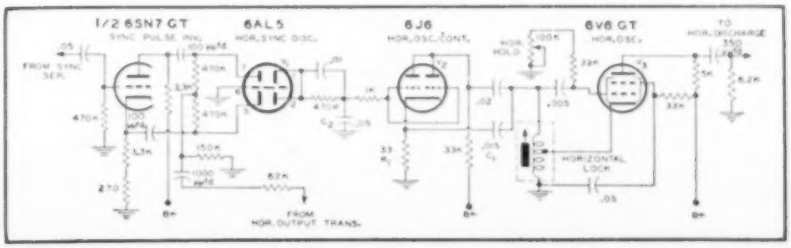


Fig. 6. A horizontal sweep system which utilizes a combination of saw-tooth and sine wave automatic frequency control. The phase relationships of this control circuit are shown in Fig. 7.

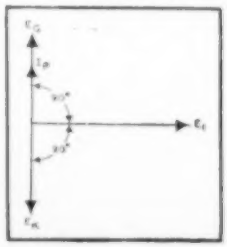


Fig. 7. Phase relationships in control circuit of Fig. 6.

sine wave systems. This system is used in *Admiral* Model 30A1 sets. It consists of a horizontal sync discriminator, a reactance tube, and a Hartley oscillator. A long-time constant *RC* filter is inserted between the sync discriminator and the reactance tube to permit only the slow changes in sync pulse timing (if any) from altering the frequency of the Hartley oscillator.

The entire a.f.c. circuit, in detail, is shown in Fig. 6. The two diodes of the horizontal sync discriminator, V_1, are pulsed into conduction by a set of oppositely phased pulses received from the plate and cathode circuits of the preceding sync pulse amplifier. These same diodes also receive a saw-tooth voltage from the secondary of the horizontal output transformer. The circuit operation, thus far, is identical to the horizontal discriminator employed in the saw-tooth a.f.c. system. The amount of voltage developed across C_1 and its polarity will depend upon the phase relations between the saw-tooth voltage and the incoming sync pulses. This correcting voltage, for that is what it is, is applied to the horizontal oscillator control tube, V_2.

The triode reactance tube is connected across the tank circuit of the horizontal sweep oscillator, V_3. At the same time, the series network of C_2 and R_1 is connected across this same resonant circuit, receiving the full 15,750 cycle voltage and consequently having a 15,750 cycle current flow through it. The value of C_2 (0.015 mfd.) is so chosen that it dominates the impedance of this network, thereby causing the current that flows through this series network to lead the applied a.c. voltage by nearly 90 degrees. This current flowing through R_1 produces a voltage here which also leads the tank circuit voltage by the same 90 degrees.

This voltage variation across the cathode resistor has the same effect on the tube current flow as a voltage on the grid of the same tube which is 180 degrees out-of-phase with the cathode voltage. This is characteristic of all conventionally operated tubes. A positive voltage, for example, applied to the cathode will have the same effect as a negative voltage applied to the grid, because both will cause the tube current to decrease.

Perhaps the best way to visualize the phase relationships in the control circuit is to employ a vector diagram. This is done in Fig. 7. For reference, the voltage present across the sweep oscillator tank circuit is chosen. This is labelled E_c. The voltage across the cathode E_k, leads this voltage by 90 degrees, as determined above. The grid voltage of the control tube, E_g, is 180 degrees out-of-phase with this cathode voltage. I_p of the control tube is in-phase with E_g and is indicated so. We note, then, that I_p lags the sweep oscillator voltage by 90 degrees and since this current will pass through this tank circuit, it will cause V_1 (from whence I_p comes) to appear as an inductance placed in parallel with the tank inductance. As the current through V_1 varies, due to changes in the voltage it receives from the sync discriminator, I_p will vary, thereby varying the frequency of the horizontal sweep oscillator and forcing it to remain in step with the frequency of the incoming sync pulses.

Horizontal Oscillator Adjustment. If it is difficult to hold the picture in horizontal sync, the procedure for adjustment is as follows:

1. Turn horizontal hold control (which is located at the front of the chassis) to the extreme counter-clockwise position.

2. Adjust the iron core of the horizontal tank circuit coil until the pattern falls out of synchronization.

3. Then turn this core until the pattern just falls back into synchronization.

4. Turn the horizontal hold control fully clockwise and turn the channel switch to the next highest channel, and then back to the original channel. The test pattern or image should return in synchronization. Should the pattern be broken up, slowly turn the horizontal hold control counter-clockwise until the picture just falls into sync. It should not be necessary to rotate this countrol more than 25°, to obtain synchronization. If a greater percentage of rotation is necessary, trouble is indicated in this circuit. Typical waveforms present in this circuit, when the set is operating properly, are shown in Fig. 5.

Vertical A.F.C. System. For most normally operated television receivers, automatic frequency control of the vertical sweep oscillator is not required due to the presence of the long time-constant filter which invariably precedes this section of the receiver. However, when a set is to be operated in a fringe area, where the level of the signal is low, a.f.c. networks in the vertical system are sometimes employed. One such circuit is shown in Fig. 8. It is seen to be similar to the circuit of Figs. 1 or 2, with a saw-tooth voltage derived from the retrace pulses appearing at the plate of the vertical output amplifier, and incoming vertical sync pulses applied by the first tube. These two voltages are compared as to frequency in the 6AL5 sync discriminator. Any difference in frequency produces a voltage at point *A* which is amplified by a triode (½ of 12AU7) and then applied as a regulating voltage to the vertical blocking oscillator.

Throughout the circuit, the time constants of the various resistance-condenser networks have been lengthened considerably over their counterparts in the horizontal automatic frequency control circuits. The operating frequency of the vertical sweep system, 60 cycles, is approximately 262 times lower than the operating frequency of the horizontal sweep system and the time constants of the *RC* networks are increased by roughly the same factor.

One final word about this particular circuit (Fig. 8). The vertical output tube, a 6AQ5, is being used here as a triode. This lowers its plate resistance and permits it to act as a partial damper across the vertical deflection coils, reducing the ability of any shock-excited oscillations in the coils to exist for more than a cycle.

(To be continued)

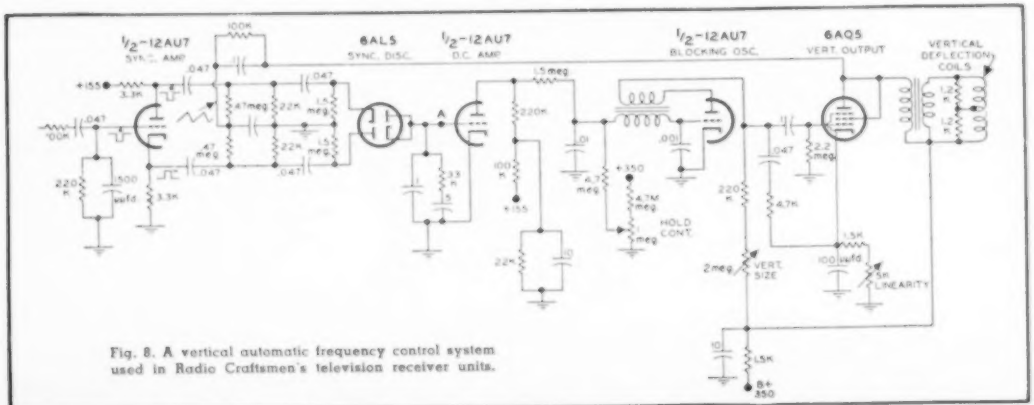
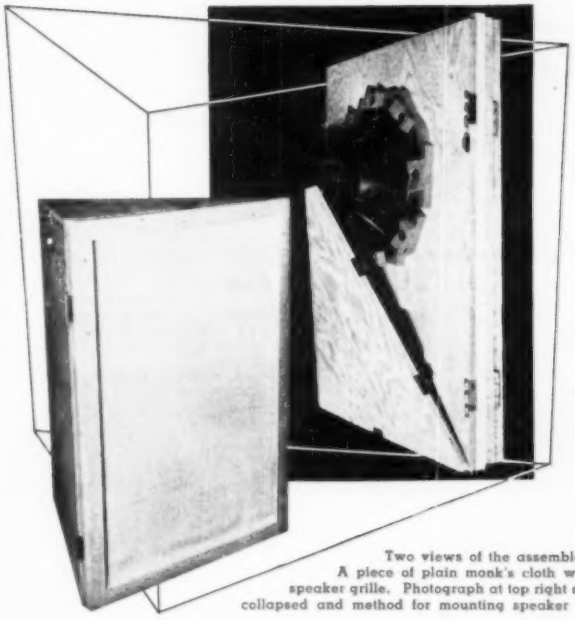


Fig. 8. A vertical automatic frequency control system used in Radio Craftsmen's television receiver units.

A COLLAPSIBLE SPEAKER CABINET

By
MICHAEL WOLFE

Details for constructing a handy speaker housing which may be used as a portable unit with temporary p.a. installations.



Two views of the assembled baffle unit. A piece of plain monk's cloth was used as a speaker grille. Photograph at top right shows the unit collapsed and method for mounting speaker with gaskets.

ONE of the basic characteristics of present-day moving cone loudspeakers is the necessity for some form of baffle arrangement to prevent the out-of-phase radiation from the rear of the loudspeaker from canceling the signal from the front. For the higher frequencies, this problem is not severe as a baffle of relatively small dimensions is usually sufficient, but for adequate low-frequency response a baffle or enclosure of considerable dimensions is often required.

To the operator of high quality public address or sound reinforcement systems, the bulkiness of conventional speaker enclosures may represent a considerable problem from the standpoint of transportation. In many instances a compromise is made in the form of a small, open-backed enclosure slightly larger than the speaker. The low-frequency efficiency of such an arrangement is often very poor and often requires bass boost and treble cut to provide pleasing balance. For more critical applications the bass reflex enclosure is a common choice giving greatly increased low-frequency efficiency. In instances where high quality and high power are desired the corner radiator, which uses the walls of the room as portions of a folded horn, appears to be attaining increased popularity but suffers from the inherent limitation of spatial location.

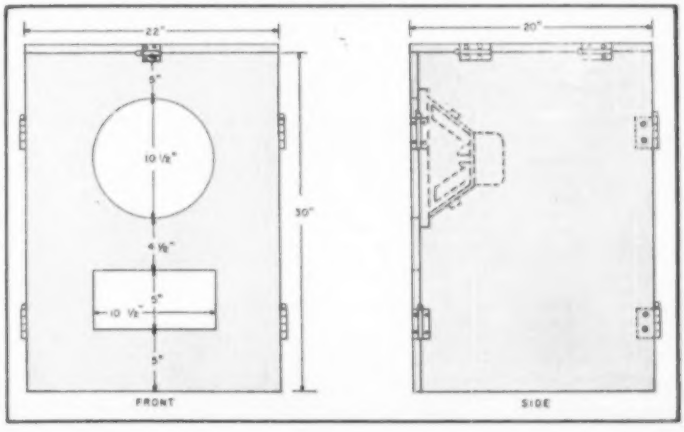
The collapsible baffle described in this article was developed primarily to fit the needs of a small orchestra playing many different engagements, often in private residences where adequate sound distribution in adjoining rooms was desired. The problem was to build an enclosure capable of wide range reproduction and yet have it of sufficiently small dimensions to fit in an automobile trunk or rear seat. One solution was to construct a baffle of fairly conventional design and provide for demountable sides, thus giving a substantial saving in volume during transportation or storage.

Dimensions of the baffle are given in Fig. 1. All sides are constructed from one-half inch, five-ply plywood to provide a fair amount of rigidity without too much weight. In the equipment shown, assembly is made through use of hinges with removable center pins. It requires the removal or insertion of eight pins to take down or assemble the unit, four pins at the front and four pins for the top, the two sides folding together. The design shown is for simple construction without need for special tools, however, the experienced woodworker with a shop at his disposal should have little difficulty in improving upon the construction. For instance, if beveled edges and inset hinges are used it is possible to have the cabinet fold together as one unit instead of three separate sections.

Although good results may be obtained by following the plans shown, many constructors may find it desirable to adapt the idea of a collapsible structure to their own particular requirements and as a result, a discus-

(Continued on page 146)

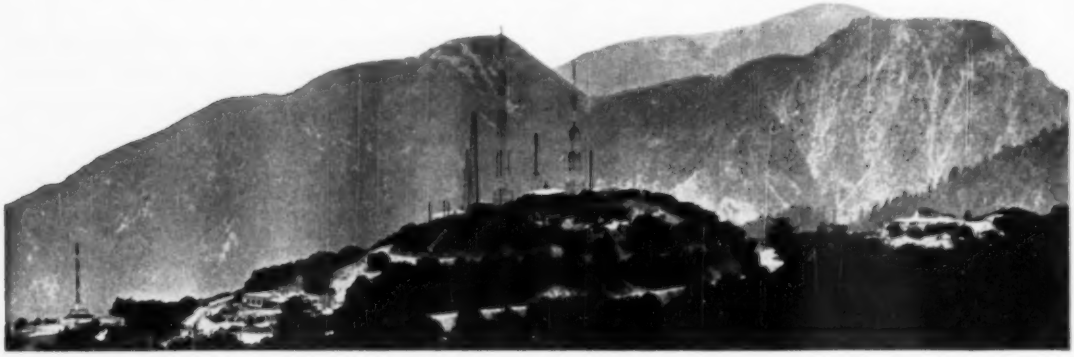
Fig. 1. Dimensions and layout of the collapsible speaker baffle. One-half inch, five-ply plywood is used throughout. All hinges have removable center pins. Side hinges should be mounted so that the center pins can be inserted from the top of the unit.



Mountain Top TV CITY

By
CHARLES D. PERLEE

California's Mt. Wilson, once famed as the home of the 100-inch telescope, is gaining an even wider reputation as a TV and FM transmitter site for Hollywood stations.



SOUTHERN California's Mt. Wilson, long famed as the home of the 100-inch telescope, has lost some of its importance as an astronomical center with the installation of the 200-inch telescope at Palomar Mountain, also in Southern California. However, Mt. Wilson, almost 6000 feet high and close to the Southwest's center of population—Los Angeles, Pasadena, Glendale, etc.—is not playing second fiddle to Palomar even though Palomar is practically perfect for stargazing because of the clearer atmosphere.

With the advent of television, Mt. Wilson has become the world's largest center of video transmissions. Television programs originate in Hollywood but they are beamed to Mt. Wilson 18 miles away. By transmitting from Mt. Wilson it is estimated that the programs can reach 500 per-cent more listeners than could be served if the programs were beamed directly from Hollywood. The Mt. Wilson transmitters, located 5000 feet higher than Hollywood, telecast Milton Berle and other TV favorites onto screens in homes up to 100 miles away. This means a potential audience of 6,000,000 in Hollywood's primary service area within the next decade.

As of October 1st the Los Angeles area's seven television stations were programming for an estimated 213,000 video screens in Los Angeles, and its neighboring cities.

Although the major emphasis has been placed on television transmissions from Mt. Wilson, other services are sharing this advantageous location. Both FM and mobile radio-telephone material is handled by these mountain top transmitters. At present there are six TV and several FM transmitters in operation at the "Mountain Top TV City," but 21 other sites have been leased or purchased, the FCC having approved a total of 27 licenses. Six other transmitters are now under construction at Mt. Wilson. In addition to the 27 licensees, 13 other television and/or FM broadcasters are jockeying for positions on this crowded mountain peak.

Earle C. Anthony, pioneer car dealer and long-time owner of station KFI, believes in the future of TV and FM broadcasting so wholeheartedly that he has purchased an entire mountain, Mt. Harvard, sister peak to Mt. Wilson, for his long-range expansion program.

Mt. Wilson, once a quiet astronomical center and the goal of nature-loving hikers and motorists, is now a bustling "city." Buildings and antenna towers have sprung up all over the mountain top. Lumber-, cement-, and equipment-laden trucks make a steady roaring parade along the 30-mile route, of which famous Angeles Crest Highway is a part, from Los Angeles to Mt. Wilson.

The intricate "brains" of Television City are housed in the huge rock building of the *Pacific Telephone and Telegraph Company*. Through this headquarters goes the cable from all of the stations in Hollywood. The building also houses the "eye" for the new mobile telephone system. Transmissions from automobiles operating in the vicinity of Los Angeles are picked up by a station located at Griffith Park Hills. From this point the message is beamed to Mt. Wilson and then to Mt. San Jacinto, the peak which overlooks Palm Springs, and from there to the home or office of the called party. Voices of motorists can now be heard exceptionally well on long distance calls and a decided improvement in transmission quality has been effected due to the high mountain beaming.

Mt. Wilson even with a Television City on top hasn't changed much. The score or more of new buildings are appropriate to the surroundings although the antenna towers, parabolic receivers, and radar-like transmitters do provide a startling contrast to the Ponderosa pines and big-cone spruces. The famous old Mt. Wilson Hotel still looks as it did 30 years ago, while nearby the six telescopes and sun towers of the Carnegie Institute's Observatory are still the scene of stellar discoveries and daily computations. The hotel's A. C. Childs gives his nightly astronomical lecture, although he now extends his remarks to include the newer wonders of TV and FM.

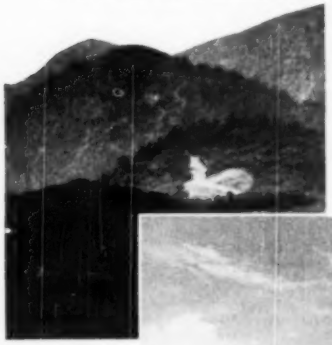
The peak's herd of 30 mule deer hasn't been frightened away by this new invasion of their domain and they and seven species of birds and a large congregation of gray squirrels are still getting their free meals of ginger snaps, fruit, and peanuts from visitors. This is one place where wild animals still have complete faith in humans and so far their faith hasn't been misplaced.

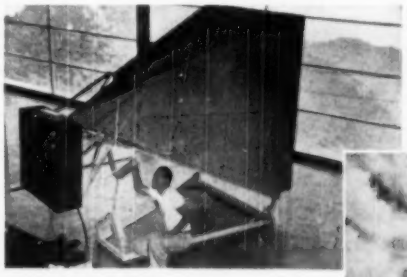
Mt. Wilson's human population is growing by leaps and bounds. There is often so much snow in this area that autos cannot traverse the slippery, precipitous roads. To eliminate this necessity, radio engineers and their families are now being housed right at the transmitter sites. It may be hard for Easterners to believe that Southern California can be the scene of devastating snowstorms but Mt. Wilson often receives as much as 30 inches of snow in a single storm. The TV people learned their lesson last winter when they didn't have engineers on duty 24 hours a day. A heavy storm hit the area, the snow piled up to over three feet, lightning struck and blew out the power system, and the engineers were snowbound at the bottom of the mountain! Video screens and FM sets in hundreds of homes were blank while engineers were scrambling peakward with dogsleds, snowshoes, and skis. That situation won't arise again. Engineers now live right at the transmitters 24 hours a day.

Thus a new and specialized "city" is growing up, 6000 feet above sea level and within easy driving distance of Los Angeles and its tremendous television market potential.

—30—

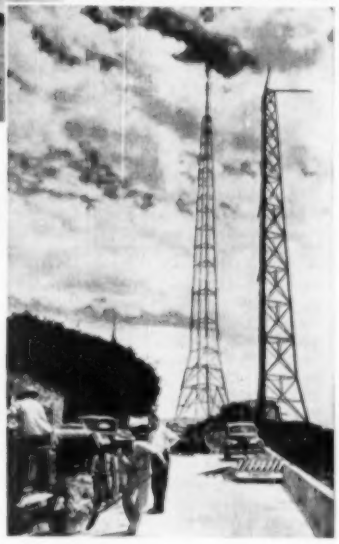
↓Over-all view of "TV City." This concentration of transmitters means improved reception for set owners. A single antenna oriented in one direction covers all broadcasts.

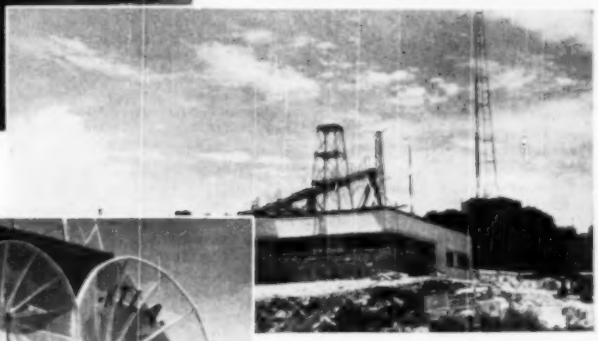




← Part of the telephone company's relay setup for mobile radiophone service. Messages are relayed from Griffith Park Hills to Mt. Wilson, thence to Mt. San Jacinto.

↓Two of the antennas on Mt. Wilson. TV unit (left) and FM tower (right) are each 199 feet high.





↓KNBH, NBC's Hollywood outlet shown during construction at Mt. Wilson. This $150,000 station is now on the air daily.

↓Mt. Wilson's "younger set," children of resident radio engineers, pose beneath KTLA's giant parabolic TV receiving horns.

→ A close-up view of Mt. Wilson's "TV City" showing the seven TV and FM towers already installed. This number will eventually reach 27 when all of the stations licensed by the FCC for this area go on the air. Television stations KTTV, KNBH, KECA-TV, KFI-TV, KTLA, and KLAC are now transmitting regularly from Mt. Wilson. KTSL, which is now transmitting from Hollywood, will soon have facilities at Mt. Wilson location.

Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

BARNEY TURNS INVENTOR

THE icy February wind carried little invitation to loiter in the great out-of-doors; and Mac, back from lunch, stepped right briskly through the door of his radio service shop. He was greeted by Miss Perkins, the office girl, with an admonishing finger raised to her lips in what was definitely a "shushing" gesture. With the other hand she pointed dramatically to a crudely scrawled placard fastened with Scotch Tape to the closed door of the service department. It read:

QUIET!
INVENTOR AT WORK!

Wondering what devilment his red-headed apprentice was up to now, Mac tiptoed across the room and soundlessly inched the door open. There at the bench sat Barney, his elbows planted on each side of a diagram-covered sheet of paper in front of him. Both of his bony hands were tightly clenching handfuls of his sorrel thatch, and his freckled face was screwed up in a look of agonized concentration. Upside down on the bench at his left was the chassis of the tube checker which had been removed from its case.

"I hate to disturb you, Mr. Inventor," Mac said softly; "but why is the tube checker lying there with its inner workings so immodestly exposed to the vulgar public gaze? Something the matter with it?"

Barney slowly turned around to confront Mac with the glazed eyes of a sleepwalker. "Oh no," he said dreamily; "I was just looking to see— Say!" he suddenly exploded as his eyes focussed on Mac's face, "I've got it! I've got it!"

"Yes, I rather suspected all along that you had it," Mac said soothingly; "but we will keep it a secret between just us two. No one else need ever know. Most of the time you act perfectly normal—"

"I mean I have just discovered a marvelous invention," Barney interrupted impatiently.

"A plastic coating on an all-day sucker to make it last two whole days, perhaps?" Mac hazarded.

Before replying Barney carefully shut the door of the service room and thrust a twisted bit of paper into the keyhole. Then he approached Mac and triumphantly announced in a hoarse conspiratorial whisper that could be heard out in the street: "A self-service tube checker!"

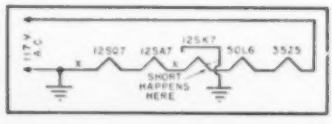
"Oh no! Not that!" Mac cried in quick alarm. "We have enough trouble now patching up the sets that customers have tried to fix themselves without being forced to stand here helplessly and watch them burn out their own tubes."

"But that is just the point. My tube checker is foolproof."

"Even against the cute helpless little woman who simply can't understand why she can't get *John's Other Wife* when the bandswitch is in the short-wave position?" Mac challenged.

"Even against her," Barney boasted. "This checker has no switches to throw, no dials to turn. All you do is take a stiff cardboard card that has the number of the tube you want to test printed on it in big letters and push that card into a slot in the checker. When the card is pushed clear in, a pilot lamp lights up behind the right socket. You simply put the tube into that socket and watch the meter hand to see if the tube is 'good,' 'bad,' or 'doubtful.'"

Fig. 1.



"Sounds wonderful—too wonderful," Mac said skeptically. "How does it work, with atomic power?"

"Nope; the secret of the whole thing lies in several little holes punched in exactly the right places in the card. When this card is pushed home in the slot, several rows of spring-actuated 'fingers' rest against it. The holes in the card allow the rounded ends of certain of these fingers to drop into them. The movement of these fingers opens or closes contacts that do the same things you do on an ordinary checker by throwing switches and twisting knobs."

"Hm-m-m," Mac hm-m-m-ed, beginning to show some genuine interest. "How are you going to replace the variable resistors?"

"By using a multi-tapped resistor with the taps being connected to one row of the fingers," Barney answered promptly.

"But the wrong fingers will be dropping into the holes as the card is slid in or pulled out. Won't that cause trouble?"

"No, because only the very last thirty-second of an inch of travel of the inserted card turns the checker on. The instant you start to pull the card out the instrument is automatically turned off.

"Just think of the advantages!" Barney rushed on. "When the customer can test his own tubes, he will feel confident he is getting an honest check. You get his business without having to lose time checking his tubes. Keeping the checker up to date is as easy as pie. When a new tube comes out, all you need is a new card. The checker will be fine insurance against the mistakes that even servicemen make now and then in operating tube testers. Think what a boon it will be to busy clerks in radio stores. Why it will—"

"Whoa there, Nelly! Slow down!" Mac commanded. Then he went on more gently: "Red, it could easily be that you have yourself a good idea there; but before you get too excited, try sleeping on it. Wait and see how it looks in the morning. Then, if it still looks good, go ahead. I'll help you all I can. But what ever started you on this inventing binge in the first place?"

"You know old man Porter, the retired railroader who lives on Bethel Street?"

"You mean old 'Packrat' Porter who boasts that he never throws anything away?"

"The same! Well, he brought down a market-basket full of old tubes for me to test right after you left. There

(*Continued on page* 105)

Over-all view of Radio Craftsmen's RC-100 TV custom receiver unit.

CUSTOM VIDEO Has Built-In BOOSTER

Details covering an interesting new high-performance set which features adjustable sensitivity.

By

CLARK E. JACKSON

THE trend in current television receiver design has been predominantly along the lines of streamlining in order to reduce the number of tubes in the receiver, a skimping and saving of component parts, reduction in chassis size and any other short cuts that would reduce manufacturing costs. As a result, the average purchaser of a television set is able to enjoy video programs at far less cost than a year or two back. However, there remains a very lush market for the aggressive television technician and dealer who gives equal attention to those who can afford and do demand something better than run-of-the-mill television. One answer to this demand can be found in a television chassis incorporating many features not found in conventional sets and designed especially for the discriminating customer.

By using finest quality components and by utilizing time-tested and proven circuits, in addition to many other special features, this set is ideally suited to custom installation and for use in fringe areas, due to its extreme sensitivity.

As a matter of fact the sensitivity of the set compares favorably with most television receivers that use separate high gain boosters, but instead of requiring two separate units the sensitivity is already incorporated within the circuitry of this new tuner.

Excellent reception is had even up to 125 miles from television transmitters. The circuit incorporates a remarkable new automatic gain control that operates instantaneously and eliminates all noticeable flutter caused by airplanes moving as fast as 300 miles per hour. It also is capable of eliminating disturbances, such as those resulting from wind-blown outdoor antenna systems and transmission lines, or from persons moving near indoor antennas.

Reference to the diagram discloses the extent to which the design has gone. Perfect interlacing and exceptionally sharp images (extremely important for the excellent picture obtainable on large kinescopes) is obtainable under all conditions of noise by an automatic phase control of both the vertical and horizontal synchronization. Vertical retrace lines are automatically removed by a special erase circuit, which operates even in the absence of a video signal.

The original design employed four 6AG5 video i.f. amplifier tubes. The new circuit employs the specially designed 6CB6 tube. This results in even better performance than was possible with the 6AG5's.

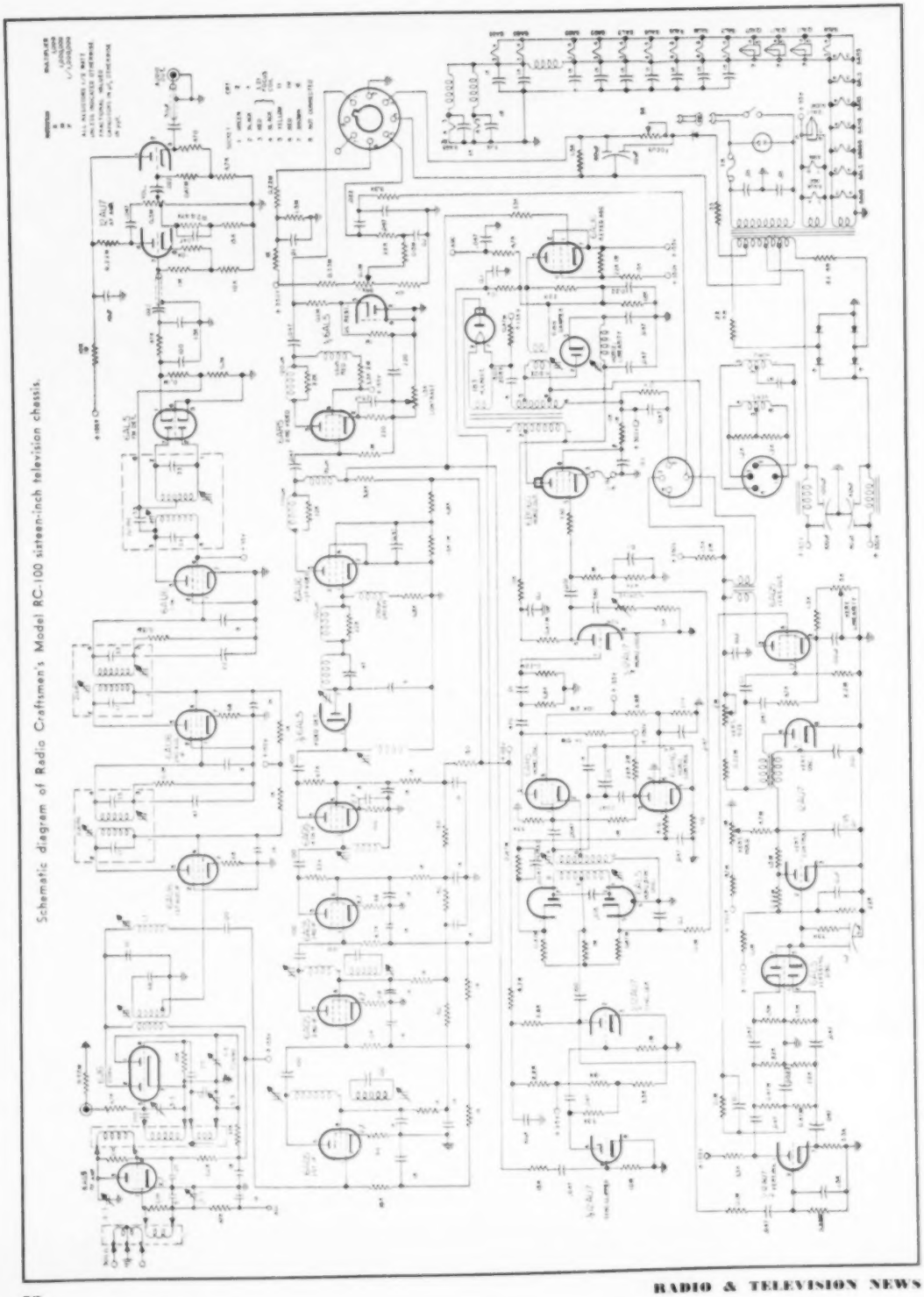
The exceptional ability to provide perfect interlacing is perhaps the most salient feature of this circuit. It means that pictures can be seen with clarity from any usable distance. It is not necessary to employ the old formula which requires the viewer to sit at a certain distance from the picture tube face. Perfect interlacing is the answer to flexible viewing distances.

A total of 25 usable tubes, plus 4 rectifiers are utilized in this circuit. A 6AG5 r.f. amplifier, 6J6 r.f. oscillator and mixer, four 6AG5 video i.f. amplifiers, 6AL5 video detector and d.c. restorer, 6AU6 video amplifier, 6AR5 amplifier, three 6AU6 sound i.f. amplifiers and limiters, 6AL5 FM discriminators, 12AU7 audio output, 6AU6 keyed a.g.c., 12AU7 sync clipper and separator, 6AL5 vertical sync discriminator, 12AU7 vertical control and blocking oscillator, 6AQ5 vertical output, 6AL5 horizontal sync discriminator, 6AH6 horizontal automatic phase control, 6AR5 horizontal oscillator, 12AU7 horizontal discharge and vertical phase inverter, 6BG6G horizontal output, 1B3GT high voltage rectifier, 6W4GT horizontal damper, and in addition, three selenium rectifiers and the picture tube. Any of the conventional 16" tubes may be used, 16AP4 through 16GP4.

A cathode follower audio output of 500 ohms impedance permits connection to any remote system. This consolidation with existing audio equipment eliminates wasted expense of minimum performance systems, currently included in many TV sets. (See editorial, January 1950 RADIO & TELEVISION NEWS.) Separate sound i.f. incorporates a double limiter and Foster-Seely discriminator for outstanding audio fidelity.

Experience has shown a definite need for separate audio systems in custom installations. In fact they are usually preferred by the customer. The selected output of 500 ohms permits accurate impedance matching to practically any high fidelity amplifier, having an input impedance of 500 ohms or more.

Of particular interest, as will be noted by examining the photos, is the unique turret tuner design. Small cartridges, each containing essential coils, are easily slipped in and out of the turret. The tuner coil cartridges



Schematic diagram of Radio Craftsmen's Model RC-100 sixteen-inch television chassis.

furnished for 12 channels can be interchanged in any desired sequence for easier front panel selection, as well as being readily replaceable with u.h.f. cartridges when these channels are made available for television.

The set is capable of being tuned to receive all FM frequencies between 88 and 108 mc. by simply tuning the slugs which are a part of each cartridge. Full FM coverage is therefore possible and the technician should query his customer as to his interest in this feature.

Controls on the receiver are simplified and include only those which are essential to normal operation. They are: Off-On-Sound Volume, Contrast, Fine Tuning, 12 Channel Selector. Secondary controls are mounted conveniently for easy adjustment on the front apron of the chassis. They include horizontal hold, vertical hold, vertical linearity, focus, brilliance and vertical size.

The sensitivity of the video channel (measured on channel 6) is 25 microvolts or less for 1 volt at the detector. The noise figure is minus 12 db.

A new development, which adds a 10 db. video boost by shifting the position of the control knob, equals or betters the performance of external boosters. It does not in any way disturb audio reception.

The input circuit employs a 300 ohm balanced primary. Separately matched transformers for each channel are provided. This provides maximum transfer of voltage from the antenna system. The video i.f. is 26.1 mc. while the audio is 21.6 mc. The bandwidth of the video is 4 mc. and the audio 250 kc. Three volts of audio output are available at 500 ohms covering the range of 20-20,000 cycles per second, at less than 1% distortion. Power supplies provide 150 volts at 180 ma., 350 volts at 140 ma. and 13 kilovolts and 500 volts horizontal kickback.

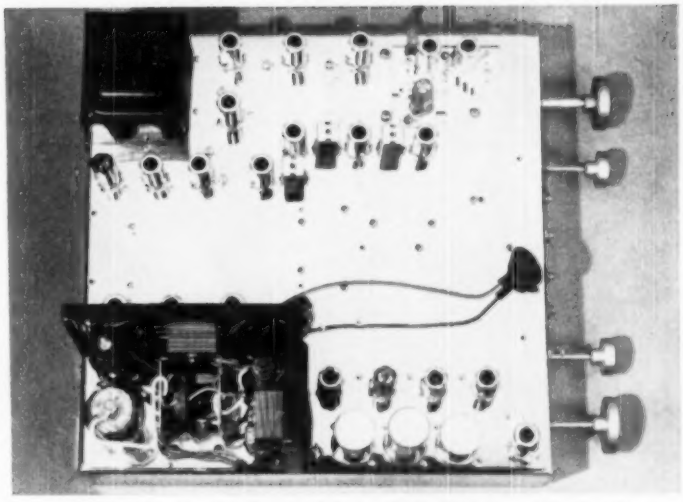
As mentioned previously, the circuit is capable of extreme sensitivity and therefore ideally suited for fringe locations. This is made possible by five separate r.f. coils, including the individually matched 300 ohm input transformers for each of the 12 channels. Tracing the circuit shows that this is followed by six amplifying stages, to provide full four megacycle bandwidth, with negligible phase distortion. Phase controlled synchronization systems, unaffected by noise, control both the horizontal and vertical sweeps. Since the receiver is completely under the control of the instantaneous automatic gain control, itself immune to noise, further improvement is obtained in the synchronization because these circuits are always working at maximum efficiency.

The circuit, with simple additions, will handle the new 14" tubes.

One of the most unique features of the assembly is a remote tube mounting. The picture tube mount has been especially designed to make the picture tube assembly removable from the receiver chassis for remote mounting. This is a particular advantage in custom installation. Five mounting screws hold the mount to the chassis. All connections to the picture tube are provided with plugs, so that extension cables can be made of the desired length and inserted in the appropriate sockets. Particular care should be taken with the high voltage extension. Use high tension wire capable of withstanding up to 15 kilovolts. The limiting factor in determining how far the tube can be removed from the chassis is the shunting capacity offered by the picture tube grid (green) lead. This lead should be run isolated from the cables and chassis and in general 6 to 8 feet will be found to be the maximum length permissible before high-frequency smearing results.

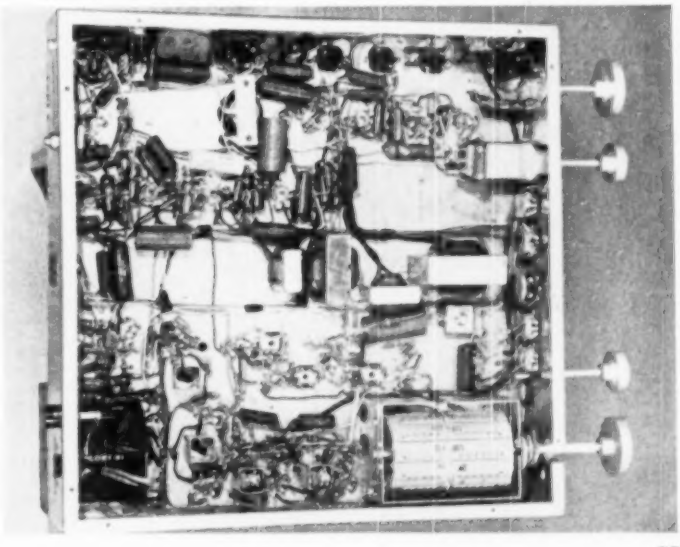
To achieve the very low heat dissipation necessary for mounting in confined areas, (wall installations, for example) a new selenium rectifier bridge circuit was developed. It permits the unusually low power consumption of 175 watts.

Many articles devoted to custom installation of television, radio, and audio have been published. The introduction of this new *Radio Craftsmen* RC-100 television receiver is certainly a step forward in the search for perfect television reception for a discriminating clientele. —30—



Top view of the RC-100 television chassis with the cathode-ray tube removed.

Under-chassis view of receiver. Either a 16 or 19 inch kinescope may be used.



ELECTRONICALLY CONTROLLED D.C. LOAD

By
MAXIME G. KAUFMAN, W30NT

Panel view of home-built unit. Meters indicate both voltage across and the current through the load.

A d.c. 50-watt resistor for direct current applications. Ideal for checking power supplies and the like.

OFTEN times a good high wattage resistive load is needed around the work shop. The stocking of various values of these components would obviously be costly. Now the electronic d.c. load to be described will take care of this problem very nicely. Some of its applications are as follows:

a. To check the regulation of power supplies.
b. To determine the approximate value of a bleeder resistance.

As an example of its use, let us say that we wish to determine the resultant voltage of our power supply when it is delivering 120 ma. to a load. The value of resistance needed across the power supply becomes awkward to calculate, since we do not know what the final loaded down voltage will be. The usual procedure at this point is by guess and by golly; however, if we have the d.c. electronic load on hand, the answer is simple. Merely connect its terminals to the power supply, turn the control clockwise to 120 ma., read the voltage and presto.

CURRENT (ma.)	VOLTAGE 100 v.	200 v.	300 v.	400 v.	500 v.
	Resistance in ohms				
50	2000	4000	6000	8000	10000
100	1000	2000	3000	4000	5000
200	500	1000	1500	2000	2500
300	333	666	1000	1333	1666
400	150	500	750	1000	1250
500	200	400	600	800	1000

Table 1. Equivalent resistance chart.

Reference to Fig. 1A readily shows the basic principle used in this electronic d.c. load. The bias control voltage varies the effective plate-to-cathode resistance of the tube, thus making it possible to vary the load presented to the voltage input.

In order to eliminate the bias battery, a full wave rectifier was incorporated as shown in Fig. 1B. To increase the power dissipation capabilities, four triode sections were paralleled as shown in Fig. 1C. Two 6AS7 tubes were used in this case; however, other types such as the 6L6G, 6Y6G, or the 829B would do as well. This circuit will handle a conservative 50 watts of dissipation.

Fig. 2 is the final schematic diagram with its associated parts list. The additional filament transformer was needed to handle the current since the winding on the power transformer used was not quite heavy enough. The completed electronic power load is shown in the photographs. The chassis is a standard 7"x11"x2" box. On the left of the front panel is a 0-500 volt meter and on the right is a 0-500 ma. meter. In the center are the pilot light, toggle switch for the bias supply and tube filaments, along with the power control knob. The placement of components and the wiring is not critical. The rear view shows the line fuse, line receptacle, and the floating input terminals. This floating feature allows the unit to be used with either a positive or negative voltage source. It may be found more convenient to

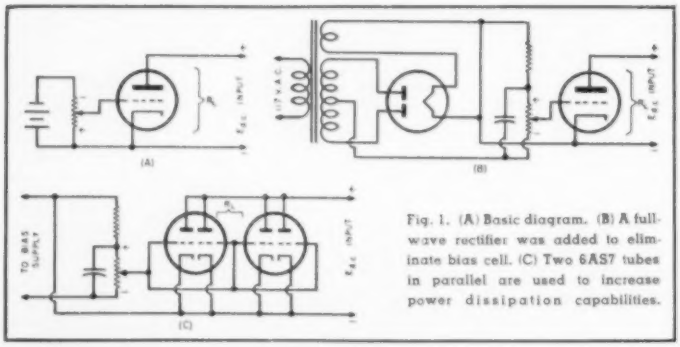


Fig. 1. (A) Basic diagram. (B) A full-wave rectifier was added to eliminate bias cell. (C) Two 6AS7 tubes in parallel are used to increase power dissipation capabilities.

locate this terminal block on the front panel.

To stay within the safe power rating of the unit, reference should be made to Fig. 4 which shows the maximum amount of current that can be drawn at any given input voltage to the unit. This curve can be reproduced and secured to the front panel for ready reference. Temporary overloads can be tolerated if not left on for prolonged periods. Some drift in current will be noted as the 6AS7 plates heat up.

To save time in calculation, Fig. 3 is handy in that it shows the equivalent resistance of the power unit versus the current being drawn. Current values in the area below the dashed curve designate the region of rated power of the tubes and can be used as a precautionary boundary when taking readings.

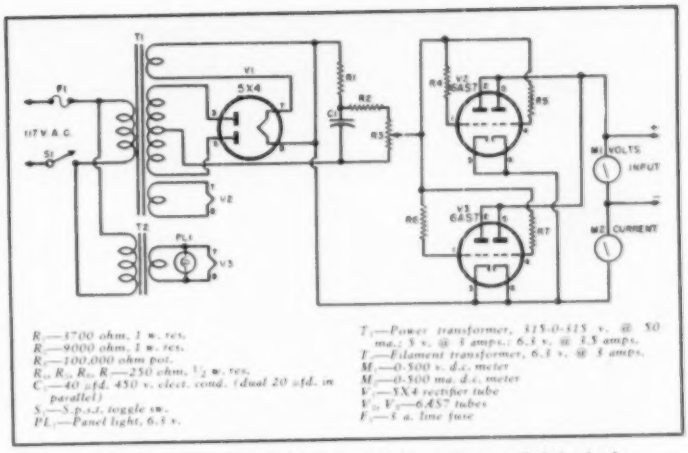


Fig. 2. Complete schematic diagram of electronically controlled d.c. load.

Applications

Checking regulated voltage power supplies becomes a pleasure rather than a task with the electronic load. In fact, the unit was designed for just that purpose. Such questions as how much current can be drawn from the regulated power supply and still have it hold its output voltage; and, what is the effect of a sudden change in the load on the supply voltage; can readily be determined. First, connect the power supply under test to the electronic load and note the voltage reading on the front panel meter. Then slowly increase the current through the electronic load with the bias control until the voltmeter gives a slight kick. The value of current, as read on the corresponding milliammeter, indicates the maximum current obtainable under regulating action.

Now to obtain an approximation of the effect of a transient load on the regulated power supply under observation, back down the control bias to about one-half of the maximum current just found in the above test on regulation. While watching the voltmeter, twist the control knob left and right rapidly. No change on the voltmeter indicates a favorable reaction on the part of the power supply.

For determining bleeder resistance values, connect the electronic load into the circuit as the unknown resistance and adjust the control knob until the required voltage is present on the voltmeter. Fig. 3 can then be used to find the resistance value needed and also the wattage requirement. Some spot equivalent resistances can be set up with the aid of the chart in Table 1.

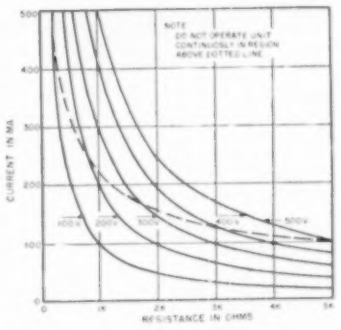


Fig. 3. Equivalent resistance value of load with given voltage and current readings.

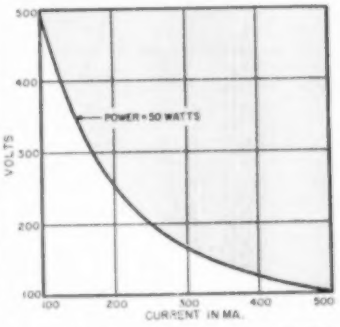
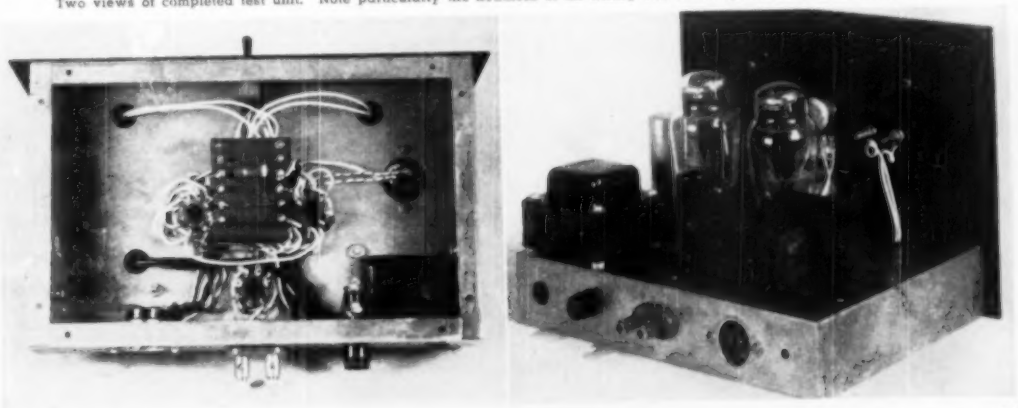
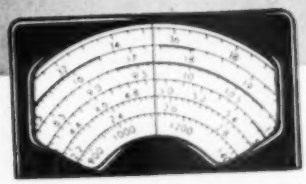


Fig. 4. Maximum current for any given voltage. Continuous overload is not advisable.

Two views of completed test unit. Note particularly the neatness of all wiring and careful positioning of all components.



International SHORT-WAVE



Compiled by KENNETH R. BOORD

IT IS a pleasure this month to dedicate the *ISW DEPARTMENT* to the Forces Broadcasting Service, Middle East. Our thanks for this material go to Leslie Knight, who is in charge of the station at HQ Forces Broadcasting Unit, MELF, Malta Garrison.

Mr. Knight informs me that the station is "still testing at the moment, and the object of these transmissions is to cover North Africa. The ultimate set-up in Malta will be three 7½ kw. transmitters—one for North Africa, one for Egypt and Cyprus, and one for Southern Europe.

"Our tests, as far as the coverage of North Africa is concerned, have not been as satisfactory as they might be. However, the Senior Technical Officer, Maurice Taylor, is ironing out the troubles.

"For this coverage we are using 4.782 and 7.270 on this schedule: 2330-0130, 4.782; 0430-1015, 7.270; 1200-1700, 4.782. We shall, of course, be using other frequencies for the other shoots, but these have not yet been decided." (*Note*: More recently I have noted the Forces Broadcasting Service, Middle East, on 11.782 at 0100 with BBC news relay. I suggest that DX-ers who fail to find the station on the frequencies listed by Mr. Knight try 11.782, 6.140, or 4.965, which are other channels tested.—KRB)

It is recalled that the FBS brought many an hour's radio enjoyment in the days of World War II to members of the three British Services. Here is the story of the development of FBS as related by Mr. Knight:

During the part of the War when servicemen were scattered in places outside the range of the BBC's domestic service, it was found that although the Overseas Short-Wave Service was good, it could not cope with the entertainment and educational needs of the serviceman. Items such as local sports, local personalities, "What's On" features, and most important, request programs, were not being covered. And so it was from the consciousness of the serviceman's need that the FBS was inaugurated.

COMING NEXT MONTH

"Around the Clock"

A table of English newscasts from short-wave stations throughout the world.

The very name itself is indicative of the thought that was behind it for, in weighing it up in the joint planning stage, it was realized that irrespective of who provided the required service, the result itself could be heard by everyone who cared to listen—soldiers, sailors, airmen, or civilians.

Under such conditions, it was considered wasteful for each service to provide its own organization. The British Army afforded the largest potential audience and so was made responsible for the organization, with the understanding that the other services would undertake their share of the task.

Organization and maintenance of FBS was entrusted to the Army Welfare Service and a special place was found for broadcasting activities within the Army framework; the RAF made itself responsible for 25 percent of the manpower required. As far as the Middle East was concerned, this activity was started in a tentative way. A Middle East Broadcasting Unit was formed and time was borrowed from the existing civilian or government broadcasting organizations that were in range of the troops. The headquarters of the Unit was based in Cairo, Egypt, under the command of Peter Hadden, who is remembered for his famous BBC series on "Cairo Calling."

The "Forces Hour" was radiated from the Egyptian State Broadcasting Station in Cairo, the Palestine Broadcasting Service, *Radio Lebanon*, and later from *Radio Baghdad*.

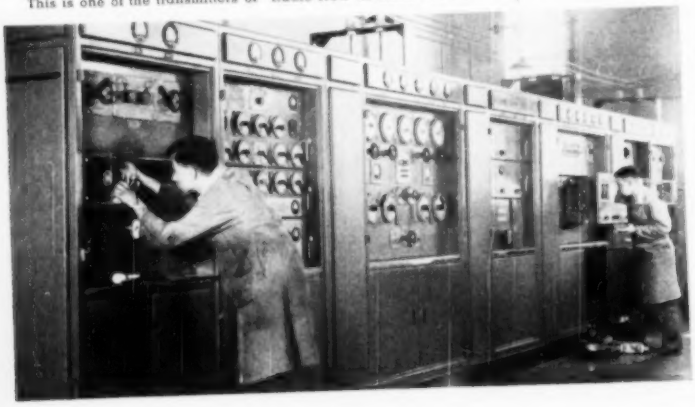
About this time, E.N.S.A. inaugurated a special transcription service for use by these networks. These programs featured the most popular artists of the day.

The air time at the Service's disposal proved inadequate and soon plans were made for the installation of the Forces' own radio stations. The RAF helped a great deal by supplying low-powered transmitters. The first full-time Forces Broadcasting Station went on the air at Gaza, Palestine, followed by a second station in Beirut, Lebanon. Site for the Gaza station proved unsatisfactory and the transmitters and equipment were eventually moved to Jerusalem. About this time, an Army Signals Station, in Cairo, began broadcasting test transmissions as JCJC. Some time later, the Service took over the operation of JCJC and the station became known as the Forces Program from Cairo.

Due to the low power of these transmitters, a second station was necessary for troops in the Suez Canal Zone. So an installation was made at Kabrit. An urgent demand came from

(*Continued on page 90*)

This is one of the transmitters of "Radio New Zealand" at Titahi Bay, near Wellington.



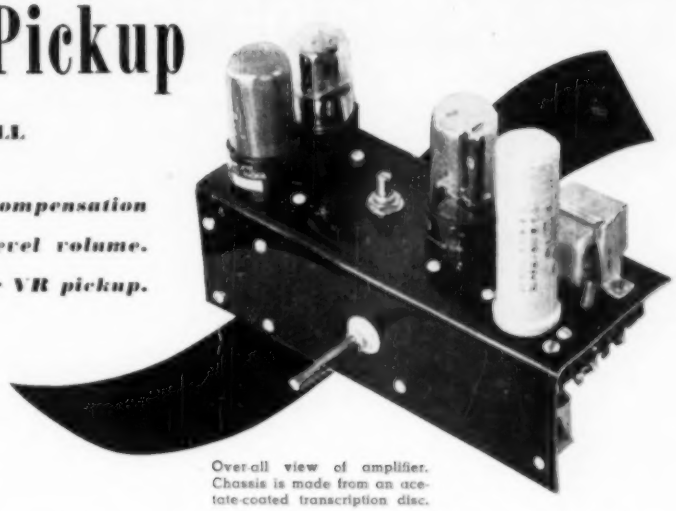
(Note: Unless otherwise indicated, all time is expressed in American EST, add 5 hours for GCT. "News" refers to bi-weekly in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given.

3-TUBE AMPLIFIER For Variable Reluctance Pickup

By EDWIN W. HILL
Chief Eng., Station WDHL

Features adjustable tone compensation and good fidelity at room level volume. Designed for either crystal or VR pickup.



Over-all view of amplifier. Chassis is made from an acetate-coated transcription disc.

SMALL, three-tube a.c.-d.c. audio amplifiers are, generally speaking, not very novel or new pieces of apparatus. However, here is a compact amplifier which differs from the usual run in that it uses only the three conventional tubes in a circuit not much more elaborate than the simplest and yet is suitable for use with a variable reluctance pickup without any further preamplification or outboard units of any kind. It can also be used with a crystal pickup, without modification, and it features adjustable equalization and good fidelity at adequate room-level volume.

This amplifier came into being as the result of a search for an inexpensive unit for reproduction of electrical transcriptions and records for audition and demonstration purposes. Since the playback outfit was intended to be carried by radio time salesmen to possible clients or sponsors, any saving in weight and space requirements was advantageous.

After considerable calculation and experimentation, a circuit was designed and constructed that met requirements in every respect. Besides being very satisfactory for its originally intended purpose, this amplifier can be used in the home record player, where only moderate audio power is desired, and it certainly brings down the cost of variable reluctance reproduction to a point where it compares favorably with that of the ordinary crystal pickup.

Only three tubes are used. One half of a 12SL7GT functions as a high gain first audio amplifier in cascade with the other half which works as a second audio amplifier, the output of which drives a 35L6GT power output tube. The rectifier is a 35Z5GT.

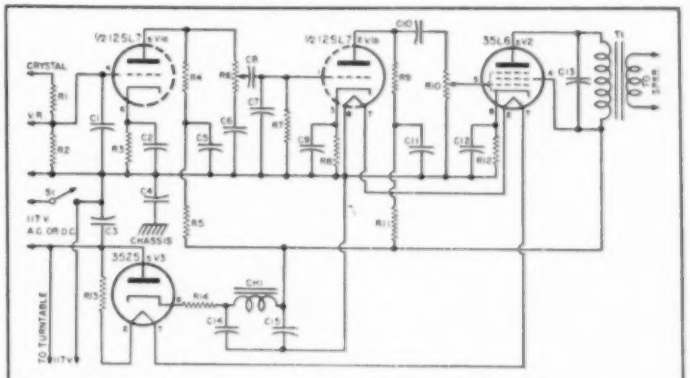
Construction of the amplifier is simple. A piece of aluminum, 5½ inches by 8 inches, was cut from a used acetate-coated transcription disc and folded 3 inches from one long edge to form a right-angle chassis. Steel, or other metal, could be used equally as well, but the aluminum from the transcription disc has the advantage that, if care is taken not to mar it during working, the acetate coating makes a smooth, glossy and very attractive "ready-made" paint job for the completed chassis.

All of the parts fit into their places without undue crowding and no special shielding or wiring precautions are necessary, other than those which go to make up good construction practice, such as making all the grid connections as short as possible and keeping a.c. wiring away from the input circuit. The under-chassis layout is shown in the photograph on page 122.

The circuit is a straightforward one and, except for certain novel features like the combination VR-crystal input and the adjustable equalization, does not need a great deal of explanation. The input to the amplifier consists of a voltage divider. The lower

(Continued on page 122)

Diagram of the three-tube amplifier for crystal or variable reluctance pickups.



R_1—1 megohm, ½ w. res.
R_2, R_3, R_{11}—20,000 ohm, 1 w. res.
R_4, R_5—15,000 ohm, 1 w. res.
R_6, R_8—500,000 ohm, 1 w. res.
R_7—250,000 ohm equalizer pot., linear taper
R_9—2.5 megohm, ½ w. res.
R_{10}—1 megohm vol. cont. & sw.
R_{12}—175 ohm, 1 w. res.
R_{13}—220 ohm, 20 w. res. or 220 ohm line cord res. (see text)
R_{14}—10 ohm, 1 w. res.
C_1—100 μfd. mica cond.
C_2, C_3, C_{12}—25 μfd., 50 v. elec. cond.
C_4, C_{10}—.05 μfd., 400 v. cond.
C_5—.05 μfd., 400 v. cond.
C_6, C_{11}, C_{13}—20 μfd., 150 v. elec. cond.
C_7, C_8—.01 μfd., 400 v. cond.
C_9—.002 μfd., 400 v. cond.
C_{15}—.02 μfd., 600 v. cond.
CH—30 ma. filter choke
T—Output trans., 35L6 to v.c. (load res. 2500 ohms)
S_1—S.p.s.t. sw. (on R_{10})
V_1—12SL7GT tube
V_2—35L6GT tube
V_3—35Z5GT tube

A New Approach To BEAM ANTENNAS

By
Major CHARLES E. SPITZ, W7JHS

Obtain optimum performance over the entire band by tuning your beam to frequency from the ground.

THE amateur who erects a beam antenna is usually prepared for a lot of cut and try, and it takes it. Perhaps he copies or buys a commercial beam. The service technician buys a commercial beam for that FM or TV installation simply because he doesn't have time to fuss with it. The purpose of this article is not to deride the manufactured products. There are good assemblies available, but to illustrate the difficult nature of beam antenna installations and the fact that the process of tuning can be readily solved by the use of a simple method.

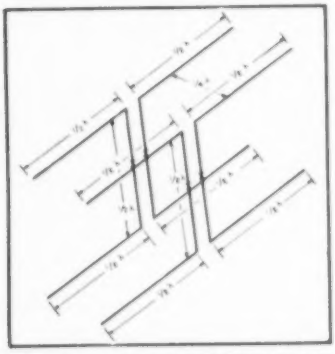


Fig. 1. "Lazy H" antenna—feedlines go to X.

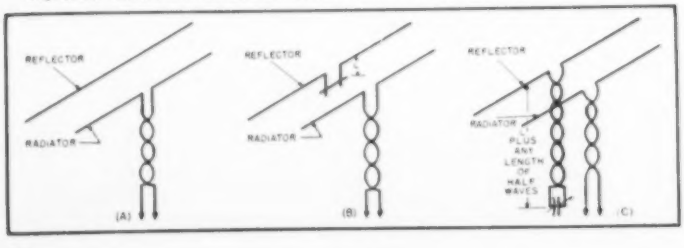
After experimenting for some time with the described system, the author has achieved results that more than came up to expectations, and possibilities seem to be unlimited.

Consider first a simple dipole and reflector. The radiator is usually cut for frequency and left at that length. Not so the reflector, however, as considerable adjusting must be done for either maximum forward gain, or front-to-back ratio at a particular frequency. Many surplus telephones have been pressed into service as a necessary aid.

It's a two-man job to adjust a receiving beam, and a three-man job for transmitting—someone has to carry the field-strength meter! If the antenna is out of reach when finally installed, as many are, a derrick is a mighty handy accessory. Most people tune on the ground and then just hope it stays that way when the antenna gets into position.

Look at Fig. 2. The classical method of adjustment is to slide small tubing ends into a larger diameter main piece, as in *A*. In *B*, tuning is accomplished by a small stub of a few inches and is the usual method for wire. It will be seen that the method in *C* is essentially that of *B*, in that the stub *L* can be tuned remotely (in effect) if the *reflector feedline* is tuned from a position any number of half-waves longer.

Fig. 2. (A) and (B) are conventional beams. Tuning method described is shown in (C).



Tuning a reflector with this system of parasitic excitation means there are standing waves on the reflector feedline; however, several experimental feedline lengths of fifty feet and beyond did not indicate excessive losses by virtue of increased lengths.

The antenna used in the tests, the results of which are shown in the graphs, consists of a radiator composed of four half-waves in-phase, two elements stacked above two, and is popularly known as the "Lazy H." A similar curtain was placed one quarter-wave behind. It will be noted that the feedlines between the upper and lower elements are not transposed, being phased by center feeding, and present a load impedance of about 70 ohms. The resultant broadband characteristic is easily seen in the graphs. For those who may be unfamiliar with the antenna, it is shown in Fig. 1.

Another advantage of remote reflector tuning is the fact that it may be tuned to any frequency, within reasonable limits, by simply turning a condenser dial at the equipment. This should be a major aid to the e.c.o. enthusiast, as well as valuable in conjunction with FM or TV channel selection.

Feedlines used in the tests were RG-11/U and RG-8/U coaxial cable with little differences noted. A field-strength meter and a folded dipole were set up 300 feet from the antenna, and with a remote meter at the operating position and the reflector tuned for maximum forward signal, the meter was set so that zero on the graph indicated a maximum signal with 100 watts of r.f. power. A Model MM2 "Micromatch" was used to monitor power level and to keep a check on standing-wave ratios. A condenser

dial reading of 100 indicated 570 $\mu\mu$fd. (two sections of 285 in parallel) and zero for minimum capacity.

The graphs *A*, *B*, and *C* of Fig. 4 illustrate the field-strength and front-to-back ratios at all positions of condenser tuning at the frequencies of 28.5, 29 and 29.5 megacycles with a 55-foot coaxial feedline from the reflector. Accurate measurements were not possible beyond —26 db., and the —30 db. measurements were filled in by over-the-air reports.

Fig. 3 shows an example of the utility of reflector tuning. A check was made for the point of maximum front-to-back ratio every 100 kc. from 29.7 to 28.4 mc., and with the aid of the graph, tuning could be set at any time at the best position for the operating frequency in use.

As may be surmised, tuning the reflector affects the standing-wave ratio of the radiator feedline by changing the antenna impedance, and the effect is noted in Table 1; however, readings of forward gain indicated little field-strength loss for ratio orders of 2 to 1.

Coverages of the frequencies 27,150 to 28,500 kc. was accomplished by use of a fifty-foot feedline. Actually a fifty-foot feedline is used with a five-foot extension plugged in for the 28.4 to 29.7 mc. range, since it was felt that introducing such variables as tuned coils would unnecessarily complicate the system.

You may note that all discussions have referred to field-strength readings and wonder about receiving capabilities. It was noted that receiving checks in the amateur band were difficult to make due to fading, which would not occur in local FM or TV areas for such reception. An interesting application came to light, however, when the author was requested by KZ5AZ, who was visiting, to hook up with a Canal Zone station, so that he could talk to his wife. The antenna was swung in that general direction on a crowded weekend. W6 and W7 signals were pouring through by the hundreds, so as each signal was tuned in, the condenser was turned until the signal dipped or rose to indicate a southeastern signal. In that manner of DF-ing, five signals were quickly selected, three turning out to be Puerto Ricans, and two in the Canal Zone, one of which, KZ5CJ (a few houses from KZ5AZ's home QTH), was quickly raised and all in a matter of a few minutes!

The coaxial feedline to the balanced antenna proved poor in receiving discrimination. However a two-wire coaxial cable such as RG-22/U should improve receiving performance considerably, and in some installations molded parallel lines, provided impedances are matched, might be suitable.

The business of trimming the reflector feedline for a desired frequency and band may bother you; however, it is suggested that whatever feedline length seems readily available be tried. If the results are not satisfactory, then the feedline may be added to until the proper frequency is reached within tuning range. This is not so difficult as it might seem, as at high frequencies the transmission-line velocity factor is taken into account. With a factor of 0.66 for coaxial cable, on ten meters a half-wave becomes about ten feet, and any tuning range within that band could be covered within any portion of it as an added length. A larger tuning condenser than that used, in order to obtain a greater bandwidth, could not be employed, as at maximum capacity the impedance becomes so low as to be the equivalent of a short circuit. Double the capacity was tried and was of no value, simply making tuning at minimum capacity critical.

The value of reflector tuning may be questioned by some who wonder about the small forward gain changes indicated. It was mentioned that a broadband antenna was used in these checks which the curves bear out. A close spaced parasitic or Yagi antenna, being of a much higher *Q* should exhibit a distinct curve about the forward line. Where a broadband antenna is in use, tuning the reflector should be of value in reducing interference, BCI, or TVI, and for all reception, short-wave, amateur, FM, and TV it should increase external signal-to-noise ratios.

Some thought was given to the use of a phasing section between two elements or curtains of an array, and tests were made. The results were poor, however, since at the reflector the direct wave, when off frequency, exhibited a phase difference to the radiated wave, and unless the spacing between the elements was also variable, the bandwidth would be limited. This effect would be aggravated by a low transmission line velocity factor.

What about tuning all parasitic elements, such as directors, etc.? What about arrangements to steer radiation angles? The author has given some thought to these problems and is conducting further experiments. The sky seems to be the limit in tuning parasitic elements, and it surely seems that the manually-tuned beam is on the way out.

Acknowledgement must be made here of the patience and valued assistance of Lynn Mutrix, W5OIX; Captain Bascom E. Tillotson, W5PDW; Chief Warrant Officer Chester B. Harmon, WOJG; Reynold B. Champagne, W4KQW; and the many others whose observations aided the work.

—30—

DIAL	0	10	20	30	40	50	60	70	80	90	100
SWR	1.3	1.25	1.1	1.02	1.09	1.1	1.11	1.15	1.15	1.17	1.17
FS	2	2.5	.5	0	0	0	0	0	0	0	0
FB	3.5	3	5	7	10.5	21.5	26.5	30	28	27.5	26

Field Strength (FS) and Front Back (FB) are in Minus DB.

Table 1. Performance characteristics of the antenna described, measured at 28.5 mc.

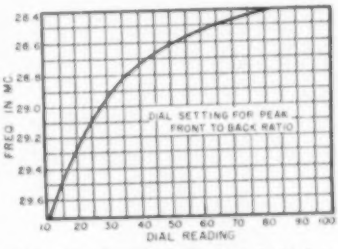


Fig. 3. Condenser settings for reflector tuning to give maximum front-to-back ratio.

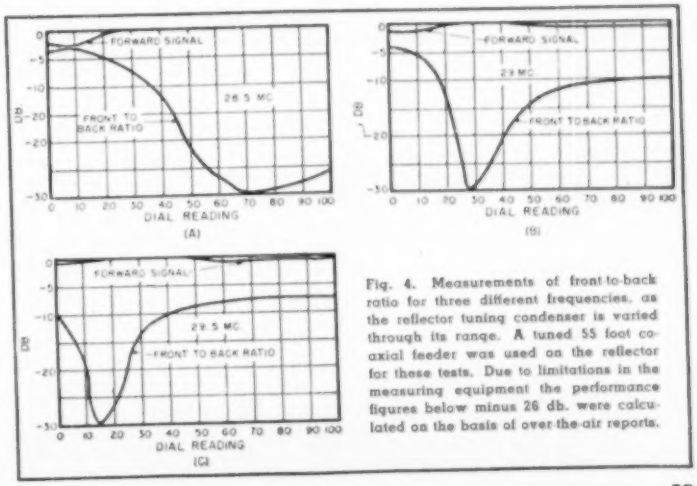
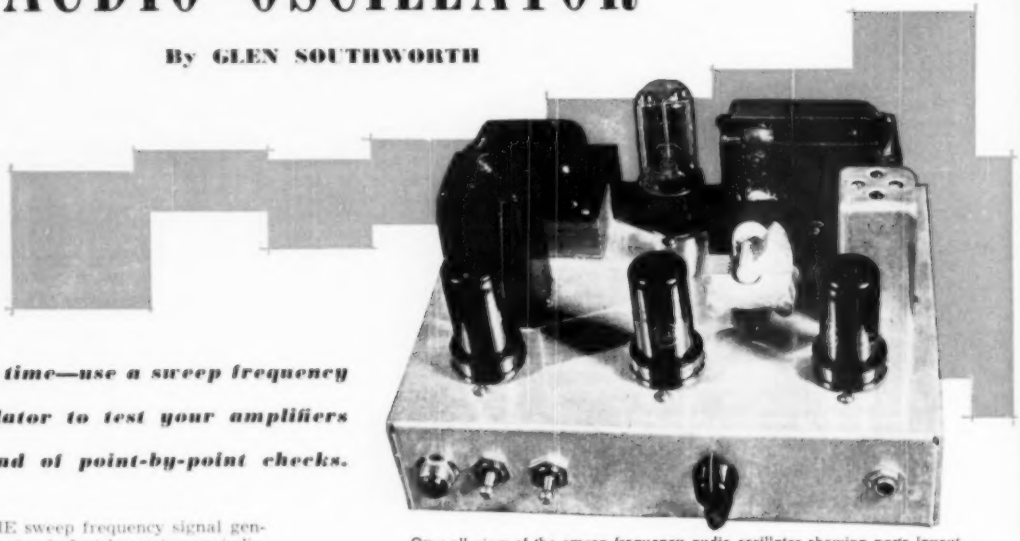


Fig. 4. Measurements of front-to-back ratio for three different frequencies, as the reflector tuning condenser is varied through its range. A tuned 55 foot coaxial feeder was used on the reflector for these tests. Due to limitations in the measuring equipment the performance figures below minus 26 db. were calculated on the basis of over the-air reports.

Build A Sweep Frequency AUDIO OSCILLATOR

By GLEN SOUTHWORTH



Save time—use a sweep frequency oscillator to test your amplifiers instead of point-by-point checks.

Over-all view of the sweep frequency audio oscillator showing parts layout. The two r.f. oscillators are at opposite sides of the chassis, mixer in center.

THE sweep frequency signal generator is fast becoming an indispensable piece of test equipment for the alignment of FM and television receivers. When used in conjunction with an oscilloscope, this instrument is capable of giving a rapid and accurate analysis of the response curves of the receiver r.f. and i.f. circuits, saving much time over point-by-point checks with a manually operated signal generator.

Lesser known than its r.f. counterpart is the audio frequency sweep generator. Used in very much the same manner, it provides a means of rapidly showing the response curve of audio equipment on an oscilloscope screen. In practice a sweep varying from fifty cycles to above twenty thousand c.p.s. may be used to check deficiencies in high or low frequency response, the effects of tone controls, inductive circuits, inverse feedback, or any other factor that may affect the frequency response of the unit under test. Particularly useful in making response curves of electromechanical devices such as loudspeakers, microphones, phonograph pickups, and recording heads, the sweep frequency generator makes it possible to observe sharply peaked resonance points that might go unnoticed in a point-by-point frequency check.

There are several methods of approach to the problem of designing a satisfactory audio sweep frequency system. One commercial system uses a rotating disc upon which the varying audio tones are drawn. A photocell and slit arrangement is used as a pickup to convert the varying light intensity into electrical energy. This piece of equipment has the advantages of stability and easy insertion of marker pulses but is usually limited to frequencies below ten thousand cycles, due to the electromechanical characteristics involved, and in addition requires an accurately drawn tone wheel.

A simple, easy-to-operate sweep generator may be built by the average constructor by using the beat frequency principle of generating an audio tone. This principle is used in a number of commercial signal generators and relies upon the fact that if two slightly varying radio frequencies are passed through a nonlinear detector the output of the detector will contain a frequency component equal to the difference between the two original frequencies. As it is a fairly easy matter to frequency-modulate one of the radio frequency oscillators by about twenty or thirty kilocycles, the resultant beat note may be rapidly swept back and forth throughout the audio range.

In the circuit illustrated, two 6J5 tubes are used as r.f. generators, operating at approximately 250 kilocycles. A small variable condenser, capable of 360 degree rotation, is placed in the grid circuit of one of the oscillators and is driven at the rate of five to ten r.p.s. by a small, geared down, phonograph motor. A 6SA7 is used as a detector and the audio component is recovered in the plate circuit.

The variable condenser used should be selected with special attention to the bearing fitting. A shaft which fits too loosely will cause erratic coverage, while too snug a fit may cause the condenser to "freeze." It would be desirable to use a condenser with ball bearings in this application. Occasionally such condensers may be found as surplus equipment.

Although not a very complex circuit, it is necessary to consider several factors in order to obtain good results. One of the most important of these is the tendency of the two r.f. oscillators to interact if any coupling exists between them. This results in distorted waveforms, especially at low frequencies, and in extreme cases a sudden cessation of audio oscillations at a few hundred cycles. This is caused by one oscillator "locking in" at the same frequency with the other. As a result, good shielding and adequate bypassing of stray r.f. is desirable.

A second factor, particularly relevant to a sweep frequency system, has to do with the low frequency limit of the sweep. If a sweep recurrence rate of sixty revolutions per second is used, the variable condenser will pass from minimum to maximum capacity in one one-hundred-twentieth of a second, a space of time long enough to permit

only a single cycle of a one-hundred-twenty cycle note, disregarding all other frequencies in the sweep. By lowering the sweep rate to about ten c.p.s. there will be a duration of about one-twentieth of a second in which presumably a twenty-cycle note could be traced. However as room must be left for higher frequencies the low frequency limit in a sweep extending to twenty-thousand c.p.s. will be approximately one hundred cycles.

A third factor, closely related to the one just mentioned, is that if the frequency variation is linear with the rotation of the variable condenser, the low frequencies from fifty to one-thousand cycles will be crowded into one-twentieth of the space of the remaining spectrum from one-thousand to twenty-thousand. This makes the low frequency end difficult to observe and again imposes a limitation on low frequency response due to the fact that the period during which the low frequencies are being produced is so brief. To overcome this problem a special condenser arrangement is used. First, the variable condenser is specially cut so that only a slight variation in capacity occurs over a considerable portion of the rotation, thus extending the period during which low frequencies are produced. Secondly, an air trimmer is placed in series with the variable condenser to provide a means of varying the sweep width from a few cycles to twenty-thousand cycles. This provision considerably increases the flexibility of the instrument by making it possible to sweep only a limited portion of any part of the audio spectrum.

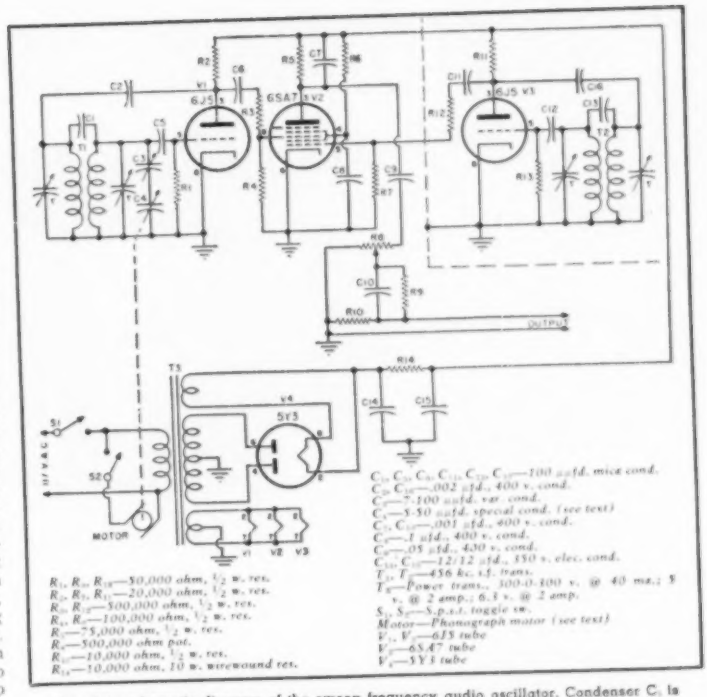
The entire unit was constructed upon a 2" x 7" x 9" aluminum chassis and the layout arranged to give good separation between the two r.f. oscillators. Little difficulty was noticed from motor vibration but care should be taken that parts are rigidly mounted and non-microphonic tubes are used. A separate switch is used for the motor in order that the system may be used as a straight audio oscillator if required. If a variable condenser with an extension shaft is available a knob and calibrated dial may be added for extra convenience.

In operation one of the first steps is to observe the output characteristics of the sweep generator itself. This is easily done by connecting the output to an oscilloscope of known flat characteristics. Often the direct output from the 6SA7 will suffer from high frequency attenuation, as illustrated in the scope photos, and it will be necessary to incorporate some form of equalization network such as shown in the schematic.

As conventional 456 kc. i.f. transformers are used in the two oscillators, the built-in trimmer condensers may be used to zero beat the oscillators when the motor driven condenser is entirely open. For greater convenience, a small shaft-driven trimmer might be brought out on the front panel for this purpose. Although zero beating may be done with the variable condenser motionless, it appears preferable to adjust the system with the motor running and while observing the pattern on the scope. In this manner the low frequency limit may be set so that a smooth pattern results without the distortion that may result from very low frequencies.

The frequency range covered will depend primarily upon the effective variation in capacity of the motor driven condenser. A variation of fifty micromicrofarads with the circuit shown should produce a frequency deviation of approximately thirty kilocycles and is a useful range for checking high frequency and ultrasonic peaks or dips in audio amplifiers. In testing limited range equipment, such as loudspeakers or electromechanical devices, a range of ten kilocycles or less is usually sufficient and a series

(Continued on page 98)

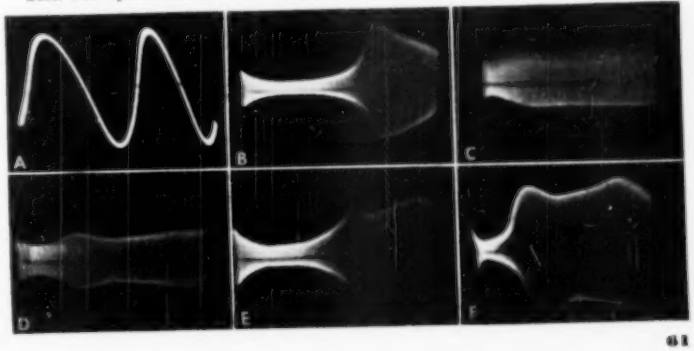


C_1, C_2, C_3, C_{11}, C_{12}, C_{13}—100 μμfd. mica cond.
C_4, C_5—.002 μfd., 400 v. cond.
C_6—7-100 μμfd. var. cond.
C_7—5-50 μμfd. special cond. (see text)
C_8, C_9—.001 μfd., 400 v. cond.
C_{10}—.1 μfd., 400 v. cond.
C_{14}—.05 μfd., 400 v. cond.
C_{15}, C_{16}—12/12 μfd., 350 v. elec. cond.
T_1, T_2—456 kc. i.f. trans.
T_3—Power trans., 300-0-300 v. @ 40 ma.; 5 v. @ 2 amp.; 6.3 v. @ 2 amp.
S_1, S_2—S.p.s.t. toggle sw.
Motor—Phonograph motor (see text)
V_1, V_2—6J5 tube
V_3—6SA7 tube
V_4—5Y3 tube

R_1, R_3, R_{13}—50,000 ohm, ½ w. res.
R_2, R_5, R_{11}—20,000 ohm, ½ w. res.
R_4, R_{12}—500,000 ohm, ½ w. res.
R_6, R_{14}—100,000 ohm, ½ w. res.
R_7—75,000 ohm, ½ w. res.
R_8—500,000 ohm pot.
R_9—10,000 ohm, ½ w. res.
R_{10}—10,000 ohm, 10 w. wirewound res.

Complete schematic diagram of the sweep frequency audio oscillator. Condenser C_7 is used to vary the sweep width while condenser C_6 is the specially cut motor driven unit.

Scope patterns taken with the aid of the sweep frequency oscillator. (A) A stationary sine wave output. (B) Unequalized output of the sweep generator. Due to faulty sweep synchronization, low frequencies appear at the right hand side of the picture. Gradual slope caused by the specially cut condenser is apparent when compared to the slope caused by the uncut side. (C) Equalized output of generator shows flat response with slight attenuation at low frequency end. (D) Output of audio amplifier feeding a loud speaker load. Slight hum in high frequencies is caused by increase in speaker impedance not entirely corrected by inverse feedback. (E) Amplifier with controls set to boost bass. Poor sync makes low frequencies appear on right. (F) Amplifier with treble boost.



An ELECTRONIC METRONOME

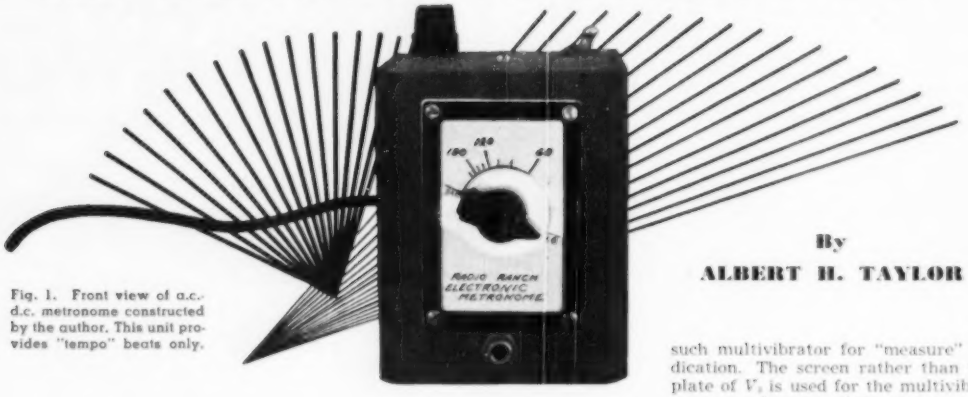


Fig. 1. Front view of a.c.-d.c. metronome constructed by the author. This unit provides "tempo" beats only.

By
ALBERT H. TAYLOR

Construction details covering an inexpensive yet accurate metronome for the serious music student.

THE familiar ticking metronome with its swinging wand which has accompanied the labors of music students for generations can now be replaced by a simple electronic circuit which has fewer moving parts and is not sensitive to position nor easily damaged by dropping.

Metronomes customarily are adjustable to beat from 40 to 208 times per minute. In addition, some, but not all, have a mechanism for accentuating every second, third, fourth, or sixth beat with a bell or a louder tick to indicate measures. A musician whom the author consulted stated that signatures with anything up to twelve beats per measure are sometimes encountered, although this is very rare. The electronic metronome can meet all of these requirements without additional complications.

Circuits

Fig. 2 shows a very simple thyratron circuit which operates from the a.c. power line. One small thyratron is used to control the "tempo" function while a second operates the "measure" circuit. Fig. 3 is the circuit diagram of an a.c.-d.c. multivibrator circuit which provides the "tempo" function exclusively. A second multivibrator can, of course, be synchronized with the circuit of Fig. 3 to indicate "measure" in the same instrument.

The circuit of Fig. 2 operates in the following manner.

Tempo Section. When V_1 fires, C_1 is charged up very quickly to the plate voltage supply voltage minus the arc drop of the thyratron; in this case it charges to 142 volts. The brief surge of current causes the relay to give a smart click which resembles the tick of an ordinary metronome. As soon as the voltage across the tube itself drops below the arc drop, the tube de-ionizes. C_1 now discharges through R_1.

Since the control grid of V_1 is biased about +50 volts with respect to "B−," the tube will again fire when the voltage on the condenser has dropped from 142 to about 50 volts. The voltage across the tube itself is approximately 100 volts at this point.

Measure Section. For delivering an accentuated beat or bell stroke at the beginning of each measure, the second thyratron, V_2, is used in a similar circuit whose ticking rate is synchronized at a submultiple of that of the "tempo" section. The combination of C_2 with R_2,R_3 differentiates the positive surge from the cathode of V_1 into a short, sharp tripping pulse which fires V_2 somewhat earlier in each discharge of C_1 than would occur in unsynchronized operation. Variation of R_2 causes the rate of the "measure" section to jump from one to another of the successive submultiples of the rate of the "tempo" section. There is no difficulty in indicating values up to 12 beats per measure.

The circuit of Fig. 3 operates like any multivibrator in that when V_2 conducts, V_1 is driven beyond cut-off and remains blocked until C_2 has discharged sufficiently through R_1 to unblock it. Then the current flips over, V_2 is blocked, and V_1 conducts a surge of current that lasts until C_1 is discharged through R_1 (in this application a much shorter time than the other phase). The relay clicks as in Fig. 2. A negative synchronizing pulse could be taken from the plate or screen of V_1 and applied to the control grid of the tube corresponding to V_2 in another such multivibrator for "measure" indication. The screen rather than the plate of V_2 is used for the multivibrator proper because, if the plate is used, a high audio or low r.f. oscillation takes place which blocks V_2.

The parts lists accompanying the diagrams of Figs. 2 and 3 show typical values used in the construction of these two types of electronic metronomes. The cost of such components at wholesale houses, including a cabinet for a "tempo" indicator only, is approximately $8.00 at present prices. For an instrument incorporating both "tempo" and "measure" indication the cost would rise to approximately $12.00. A little luck in finding suitable war surplus items would, of course, reduce the cost of building this instrument considerably.

The ticking sound produced by this sort of a metronome depends upon the relay used and also upon the way the relay is mounted. An objectionable tinny sound can result when the relay is mounted on a thin metal wall or when the relay used incorporates a coil spring which is used on the tongue of many such units. The coil spring can be quieted by the judicious use of a little petroleum jelly.

The design equation for the RC circuit of Fig. 2 is:

$$t = EC \log \left[\frac{(E-a)(u+1)}{E+(u-1)(u+e)} \right]$$

Where: t = period in seconds or time between ticks
E = plate supply voltage
a = thyratron arc drop while conducting
n = control ratio of the thyratron
u = minus the intercept on the grid volts axis of the projected straight portion of the control characteristic curve for the thyratron
e = grid bias

In Fig. 2, when using 2D21 tubes, the various values are as follows: E = 150 volts, a = 8 volts, n = 250, u = 1.3 volts, and e = 50 volts.

The design equation for Fig. 3 is:

$$t = RC \log\left(\frac{E_\infty - E_0}{E_\infty - E_1}\right)$$

Where: E = grid voltage of V_3 with respect to "B—"
E_0 = plate potential of V_3 at zero bias with load R_7 minus plate supply voltage
E_1 = cut-off bias for V_3
E_∞ = zero in Fig. 3, but might advantageously be positive.

The values of E_0 and E_1 are approximate and should be measured dynamically with an oscilloscope. RC is R_4C_3.

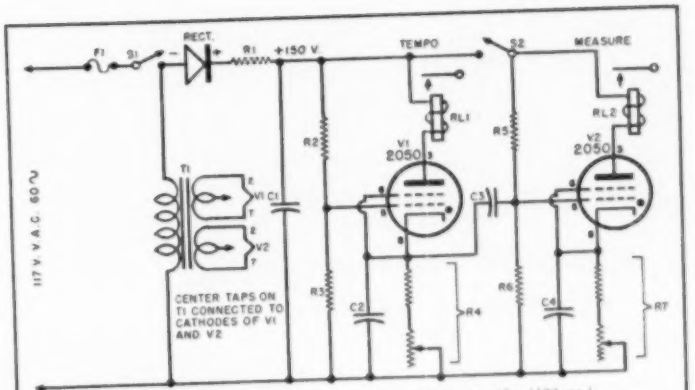
In Fig. 2 it is necessary to choose the value of C_3 large enough to click the relay with the available plate supply voltage and adjust the fixed and variable parts of R_7 to cover the desired range of "tempo" or "measure" indication. If a relay which requires too large a condenser to click it is used R_7 may be so low for the fastest rates that the thyratron will not de-ionize. Higher plate voltage permits the same energy storage in a smaller condenser.

To provide a linear rate scale on the "tempo" dial, a linear variation of conductance, i.e, a hyperbolic variation of R_7, would be necessary. However, a logarithmic scale is preferable, thus a resistance vs. rotation curve, such as *Centralab* Curve 6, can be used. In any case it takes a large dial or scale to carry all of the numerals usually put on metronomes.

The positive grid bias in Fig. 2 is important in that it minimizes the effect of tube variations. Positive bias for V_3 would be desirable in Fig. 3 if the tube selected for V_3 is one requiring but a few volts bias for cut-off.

Although types 2050 and 2D21 thyratrons have given no trouble in the circuit of Fig. 2 when the heater center tap is returned to "B—," the rated heater-to-cathode potential is, in this instance, momentarily exceeded at each tick. It is, therefore, preferable to use a separate heater winding, tied to the cathode, for each tube. Alternatively, a circuit could be constructed with RC in the plate circuit, both cathodes at "B—," and R_7 and R_8 returned to a negative bias. This would require the use of an additional rectifier which would, in most cases, cost as much as a second transformer winding.

It will be necessary to calibrate the electronic metronome in individual steps if the instrument is constructed of ordinary stock components. R_7 of Fig. 2 can be equipped with a pointer knob and a celluloid-covered paper scale with a metal rim. This scale should be large enough to accommodate all of the usual metronome figures carried on such a dial. The quickest way to get a few calibration points is to compare the ticks of the instrument with the second-ticks transmitted by WWV. It is desirable to extend the range of R_7 slightly beyond the usual metronome range in order that points at 30, 60, 120, 180, and 240 per minute



R_1—18 ohm, 1 w. res.
R_2, R_5—800,000 ohm, ½ w. res.
R_3, R_6—400,000 ohm, ½ w. res.
R_4—500,000 ohm pot. in series with a 60,000 ohm, ½ w. res.
R_7—5 megohm pot. in series with a 120,000 ohm, ½ w. res.
C_1—60 μfd., 150 v. elec. cond.
C_2, C_4—4 μfd., 150 v. oil-filled cond.
C_3—250 μμfd., mica cond.
F—½ amp. line fuse
S_1, S_2—S.p.s.t. toggle sw. (switches may be on R_4 and R_7 if desired)
Rect.—Selenium rectifier (100 ma.)
T_1—Fil. trans., 117 v. pri.; 6.3 v. @ 2 amps., c.t.; 6.3 v. @ 2 amps., c.t. (two separate transformers may be used)
RL_1—Midget type 24 v. d.c. relay, 320 ohm coil
RL_2—Same as RL_1 (if bell is desired, rewind doorbell to higher impedance and do not use interrupter)
V_1, V_2—2050 or 2D21 thyratron tubes
Cabinet—Bud C-1784 for "tempo" only, larger unit needed for "tempo" and "measure" metronome.

Fig. 2. Diagram of electronic metronome which provides tempo and measure indication.

may be obtained. Some users consider these points sufficient and are content to interpolate intermediate points. A metronome now under construction for a blind piano teacher has various numbers of screw heads placed opposite the pointer position at these WWV points which can be felt to read the tempo.

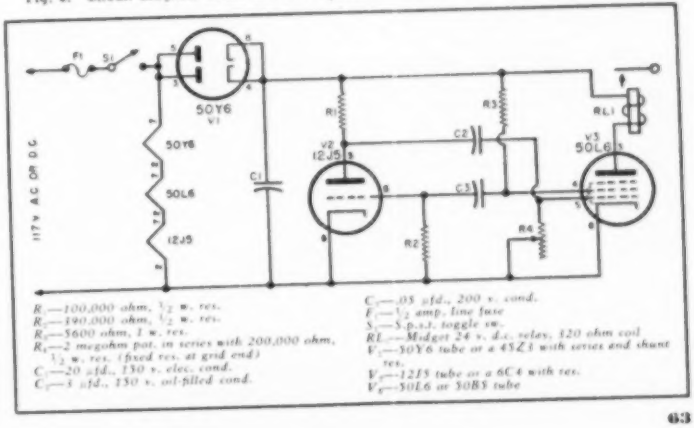
The "measure" section needs no calibration. After "tempo" has been set as desired, the "measure" knob is merely turned until the bell or reinforced beat is heard at the correct number of beats apart.

If fine calibration is required, a counter such as the *Cenco* No. 72506, can be operated by the "tempo" relay contacts and used with a stopwatch.

Large variations in line voltage appear to have no effect on the rate of the instrument shown in Fig. 2. The circuit of Fig. 3 was not tested for the effects of line voltage variation. The calibration of the metronome of Fig. 2 was stable in several hours of operation and with several different thyratrons. Longer tests have not been made. High absolute precision is not considered necessary in a metronome, however, if the grid of V_3 in Fig. 2 is led to a potentiometer inserted between R_5 and R_6, any user can easily reset the instrument so that it will beat with WWV or the ticks of a clock.

It is very important that R_5 and R_6 have nearly identical temperature coefficients and be located close together and away from a heat source. A carbon resistor over the tube for R_6 caused severe warm-up drift and had to be replaced by a better unit placed in a cooler location. —30—

Fig. 3. Circuit diagram of the a.c.-d.c. metronome which gives tempo indication only.



R—100,000 ohm, ½ w. res.
R_2—190,000 ohm, ½ w. res.
R_4—5600 ohm, 1 w. res.
R_3—2 megohm pot. in series with 200,000 ohm, ½ w. res. (fixed res. at grid end)
C_1—20 μfd., 150 v. elec. cond.
C_2—3 μfd., 150 v. oil-filled cond.
C_3—.05 μfd., 200 v. cond.
F—½ amp. line fuse
S_1—S.p.s.t. toggle sw.
RL—Midget 24 v. d.c. relay, 320 ohm coil
V_1—50Y6 tube or a 45Z3 with series and shunt res.
V_2—12J5 tube or a 6C4 with res.
V_3—50L6 or 50B5 tube

INSTANT HEATING DEVICES

By NORMAN L. CHALFIN
Crystal Devices Co.

Fig. 1. Child's phonograph with carbon pickup. Lifting arm places unit in operation.

Description of several different circuits suitable for equipment requiring instantaneous operation.

THERE are several types of electronic equipment that should be designed to operate instantaneously.

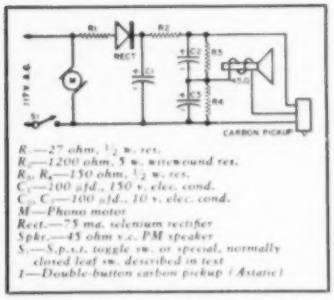
A phonograph or radio designed for a child's use is one type of equipment which should function immediately as soon as the small fry turns it on. Any prolonged warm-up period will probably mean that the youngster will abandon the instrument before it starts full operation and thus the unit will keep running for some time unattended.

Another type of equipment which must operate at once if it is to be of any practical value is the intercommunicating systems found in offices and other business establishments, and the telephone amplifier. With most standard circuits these instruments must be on throughout the working day no matter how infrequently they may be used. While power consumption on such units is relatively small, over a period of time the cost of continuous operation can become a sizable item, especially if a large number of these instruments are in use. The author estimates that approximately 70 per-cent of such power costs can be saved through the use of instant heating devices. In addition, substantial savings can be effected on maintenance and replacement parts when such devices are used intermittently, rather than continuously.

The convenience of having a home radio receiver operate instantaneously is generally conceded by most householders, especially if they have missed time signals or brief news reports during a warm-up period.

Commercially available components now make possible the construction of instant heating apparatus which is both economical in operation and in initial cost. This writer's experience has been that the quick-heating tubes and selenium rectifiers commonly used in such devices are as rugged as some of the separately-heated cathode types, if not more so.

For any electronic apparatus one of the first things to be considered is sources of power. In instant heating devices the filament-type tubes such as the 80 or 5Z3 can be used as "B" supply rectifiers. Filaments of other



R_1—27 ohm, ½ w. res.
R_2—1200 ohm, 5 w. wirewound res.
R_3, R_4—150 ohm, ½ w. res.
C_1—100 μfd., 150 v. elec. cond.
C_2, C—100 μfd., 10 v. elec. cond.
M—Phono motor
Rect.—75 ma. selenium rectifier
Spkr.—45 ohm v.c. PM speaker
S_1—S.p.s.t. toggle sw. or special, normally closed leaf sw. described in text
1—Double-button carbon pickup (Astatic)

Fig. 2. Circuit diagram of the carbon pickup phonograph made especially for children.

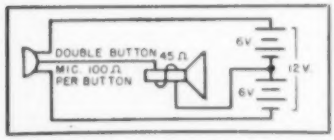
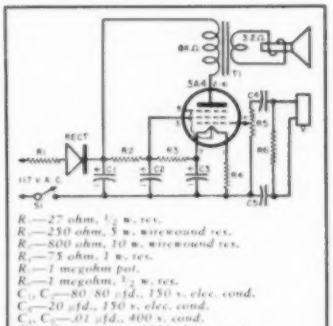


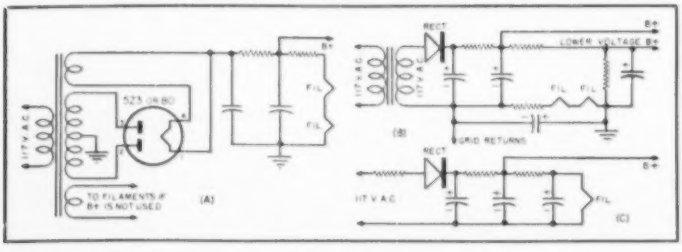
Fig. 3. Amplifier to be used with double button carbon microphone covered in text.



R_1—27 ohm, ½ w. res.
R_2—250 ohm, 5 w. wirewound res.
R_3—800 ohm, 10 w. wirewound res.
R_4—75 ohm, 1 w. res.
R_5—1 megohm pot.
R_6—1 megohm, ½ w. res.
C_1, C—80-80 μfd., 150 v. elec. cond.
C_2—20 μfd., 150 v. elec. cond.
C_3, C_5—.01 μfd., 400 v. cond.
T—Output trans., 8000 ohms to v.c.
Rect.—150 ma. selenium rectifier
S_1—S.p.s.t. toggle sw.
1—6A4 tube
1—Crystal pickup

Fig. 4. Circuit diagram of phonograph unit employing quick-heating vacuum tubes.

Fig. 5. Three representative quick-heating power supplies for various applications.



tubes used in the apparatus can be supplied through a series string with a dropping resistance from the "B" supply. Where hum is not a critical factor, suitable filament transformers could be used. For a.c.-d.c. operated apparatus (the so-called transformerless units) the selenium rectifier is definitely indicated. In such a case where filament-type tubes are used the only practical filament source is from the "B" supply through a suitable dropping resistance. In this instance, of course, the rectifier rating must take into consideration the filament current in addition to the plate currents of the other tubes. Several representative power supply arrangements are illustrated in Fig. 5.

The filament-type tubes that can be used in instant heating apparatus have characteristics which closely parallel their separately-heated cathode counterparts. A representative list of comparable types is given in Table 1 (Page 88). Consideration will be given to vacuum tube instant heating devices a little later in this article.

One of the most often encountered units incorporating instant heating features without the use of vacuum tubes is a child's phonograph. This instrument operates from the power line, uses no vacuum tubes, and delivers a substantial output from the loudspeaker. The primary element in this phonograph is a double-button carbon pickup made by *Astatic*. The circuit of the carbon pickup record reproducer is shown in Fig. 2. The unique bridge circuit employed is the subject of patent applications prepared by the author. The selenium rectifier, which requires no warm-up period, delivers d.c. directly from an a.c. power line. Through a dropping resistance, 12 volts of button current, tapped at 6 volts, is supplied. The rest of the connections can be readily determined from the diagram.

When a variable resistance device, such as the carbon microphone or pickup, is employed, the optimum output conditions are obtained when the load is one-third of the quiescent button resistance. For this reason a 66⅔ ohm impedance speaker would be desirable. Since a 45 ohm voice coil impedance was the closest thing available in a speaker such a unit was incorporated in the phonograph.

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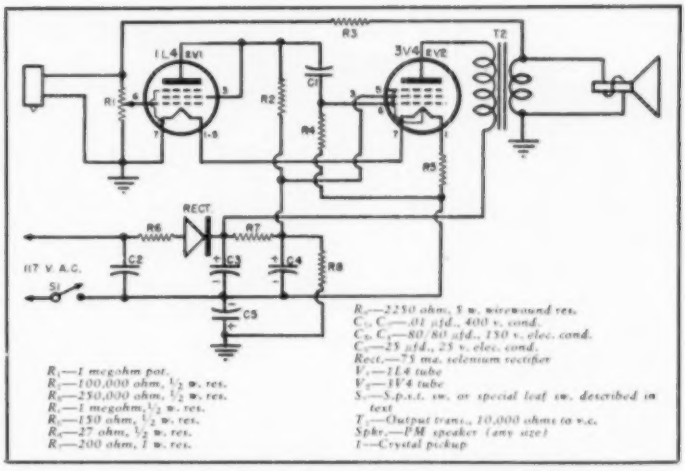


Fig. 6. Circuit diagram of a two-tube, quick-heating phonograph amplifier unit.

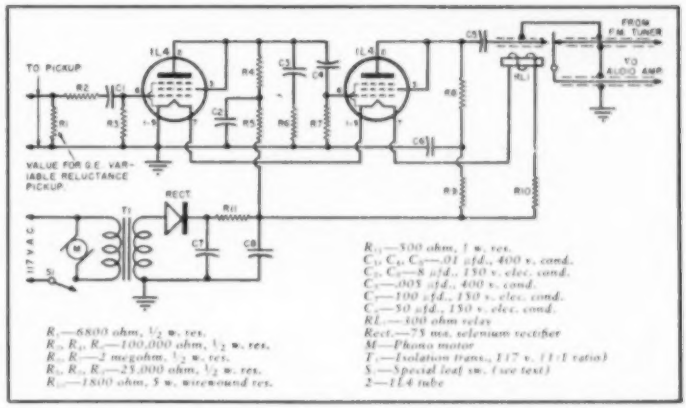


Fig. 7. Schematic of a self-switching, quick-heating phonograph preamplifier.

Fig. 8. Bottom view of FM tuner with preamp added. Isolation transformer is to left of filter block (upper flange) while rectifier strip can be seen on the left wall of the chassis.

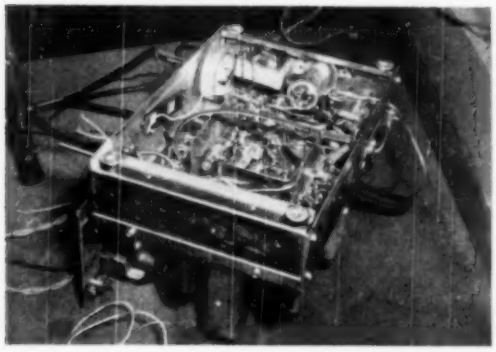
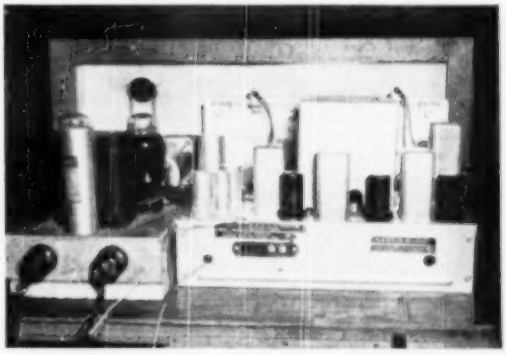
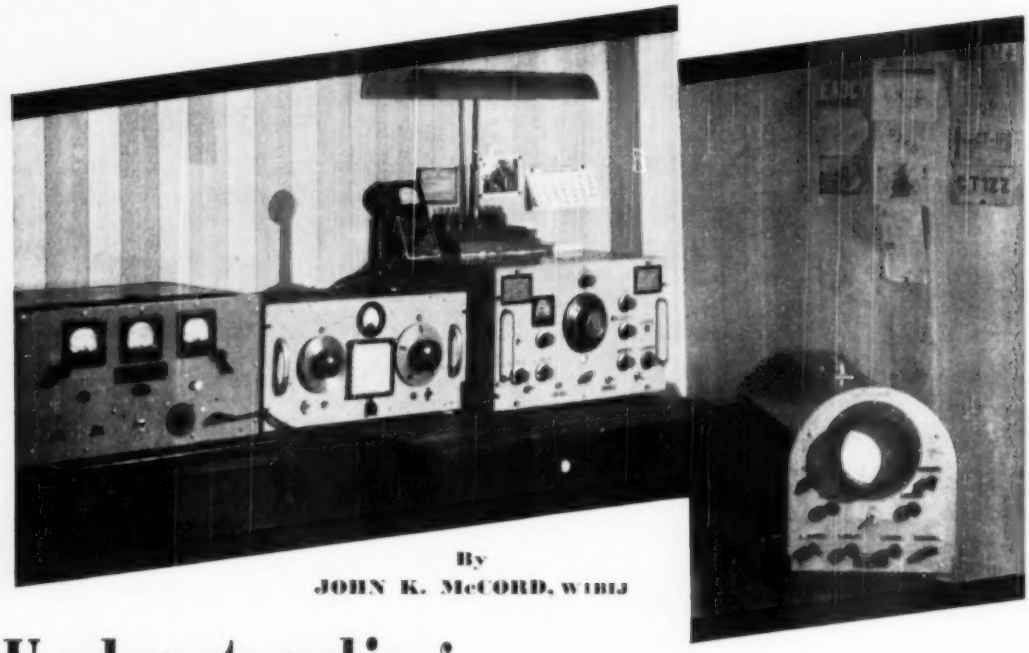


Fig. 9. The two-tube phono preamp assembled on a General Electric FM tuner chassis from which the power supply has been removed. Unit to the left of tuner is the power amplifier.





By
JOHN K. McCORD, W1BIJ

Understanding SUPER-MODULATION

Super-modulated amateur station designed and built by W1BIJ. (Left to right) Super-modulated final amplifier using 807's, the v.f.o. and driver, 15-tube superhet for ham bands, and the 12-tube Panadaptor used in the signal comparison tests at the station.

How it works, tuning instructions, and a comparison with other modulation methods, as seen on a Panadaptor.

A NEW method of amplitude modulation has appeared recently. It is simple and efficient and readily adapted to amateur use. In building a low-power transmitter using the "super-modulation"* principles and getting it on the air, several major differences, compared to regular AM methods, were noticed. This article will explain in practical "ham" language what happens in a super-modulated rig that makes it so different from conventional AM transmitters. A step-by-step tuning method and panoramic comparison with other systems will also be covered. Fig. 2 is the home station final using 807 tubes in super-modulation.

For a basic understanding of super-modulation operation see Fig. 1. The unfamiliar tank circuit is electrically the same but redrawn to simplify an understanding of the action. The r.f. tube functions as a regular class "C" amplifier. The p.m. or r.f. modulator tube, being biased about four times cut-off, doesn't go to work until you speak into the microphone to modulate. The r.f. tube makes the carrier and the p.m. tube puts your voice on it by adding r.f. power to the common tank at an audio rate.

Fig. 4 shows the super-modulation output waveform and its separate components drawn on a common time base. As the p.m. tube's fixed grid bias is series-fed through the modulation transformer secondary, and the r.f. tube bias is in shunt to the transformer center tap (see Fig. 2), the first audio voltage cycle from the modulation transformer secondary being a.c., alternately adds and subtracts from the fixed bias supply voltage. As a result both the r.f. and p.m. tube outputs increase and decrease accordingly. At time instant "A" in Fig. 4, an unmodulated carrier from the r.f. tube is shown. At "B," the start of the first positive audio alternation increases the r.f. carrier slightly to provide a cushion for the coming p.m. tube operation. At "C" the full peak of the positive audio alternation has cancelled out the p.m. tube's fixed bias and driven the grid positive resulting in a very large amount of power released. At this point the p.m. tube demands maximum r.f. grid drive. By preference less drive is left for the r.f. tube grid and its output drops, suppressing the carrier. At "D" the p.m. tube's power cycle is ending and the r.f. tube's carrier rises as a result of returned grid r.f. drive and provides the final cushioning. At "E" the negative audio alternation adds to the p.m. tube's fixed bias and the p.m. grid is momentarily about eight times cut-off. Through the modulation transformer center tap this same negative voltage adds to the r.f. tube's fixed bias and decreases its output, forming the negative or valley portion of the output waveform. This completes one cycle of audio voltage from the modulator and this is repeated for each succeeding cycle. This method of AM modulation has the following advantages. The positive waveform peaks can be extended to a point only limited by the p.m. tube's plate saturation point and the r.f. carrier can be suppressed at the same time. Using regular AM methods, extending the positive peaks beyond the 100% modulation level

* Taylor, R. E., "The Taylor Super-Modulation Principle," RADIO & TELEVISION NEWS, Sept. and Oct., 1948.

would result in a clipped carrier. With super-modulation the r.f. tube supplies some carrier at all times and fills in between modulation peaks, preventing carrier clipping regardless of how high we extend the positive peaks, and it's the peaks that carry the voice intelligence.

Regarding power supply requirements, two plate supplies are not needed. The r.f. and p.m. tubes do not draw maximum plate current at the same time, so any supply adequate for a single tube will be OK. Grid bias can be supplied either by batteries or a separate supply. I tap mine off of the driver power supply bleeder. The r.f. tube can operate with grid-leak bias, but the p.m. tube must have a fixed supply and a means of varying the bias voltage over a small range. Tuning the super-modulated transmitter is quite different from usual procedure and the method is given step-by-step below. It is assumed bugs and parasitics have been eliminated from your super-modulated final and enough r.f. drive is available for a single tube. Both finals do not require maximum drive at the same time. Start with final plate voltage *off*.

1. Vary the r.f. grid drive and grid bias voltage until the r.f. tube grid draws ½ normal drive and the p.m. grid is zero or just starting to draw current. This balance is important. Run the r.f. tube cool and let the p.m. tube do the work.

2. Closely couple a dummy antenna to the final tank and switch *on* plate voltage. The r.f. tube should load normally like a c.w. rig with the key down. Reduce grid drive rather than antenna coupling to decrease loading. The amount of coupling affects the tank impedance into which the p.m. tube works.

Keep the r.f. tube running cool at about half c.w. rating, but enough to prevent carrier clipping during modulation. An oscilloscope check will show the right point.

3. Now apply modulation while increasing the audio gain. The p.m. tube grid and plate current should both kick upward to high values. The r.f. tube grid and plate current should show a downward movement, indicating carrier suppression. My 807 p.m. tube shows plate current peaks of 80 to 100 ma. and over. As the meter indicates an average value, the true peak current is about twice that shown.

4. Disconnect the dummy antenna and load the regular antenna to approximately the same tuning values.

The oscilloscope pattern of Fig. 3 shows how the r.f. tube drive should be adjusted to prevent carrier clipping and still retain high modulation peaks. The vertical scope plates were directly link-coupled to the final tank which was loaded with the dummy antenna. *WARNING*—If scope is left coupled to tank when using antenna, r.f. may be fed to the power lines or the connecting leads may radiate, causing TVI, etc., so check this point carefully.

Checks have been made using a 5-inch Panadaptor to compare super-modulation waveforms with other signals on the air. The human ear is quite unreliable, even though we all use it for this purpose. Being logarithmic in function and having poor retaining qualities we shelved it along with the average receiver "S" meter and found the Panadaptor to be a decided improvement. Using this visual method small changes in both carrier and modulation could be seen. A change in amount of modulation not noticed by the ear can make a real difference in signal-to-noise ratio at a distant receiving location. It can mean the difference between being readable and not readable. The Panadaptor shows this difference. Fig. 5 is a mock-up waveform showing method used to determine relative signal characteristics with the panoramic image.

An average regular-method AM signal on the air appears as shown in Fig. 6. Notice that the modulation peaks extend just to *twice* the carrier height without modulation, and recede to the zero base line. This represents 100% modulation. Extending the peaks higher would also make the bottom peaks go lower which they can't do without hitting the zero base line and clipping the carrier. Fig. 7 shows a super-modulated signal of about the same power or pip height. Notice the positive peaks extended to *three* times the unmodulated carrier level, yet the carrier is a long way from being

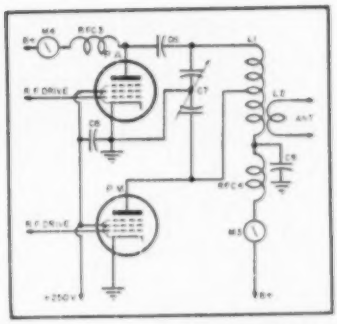
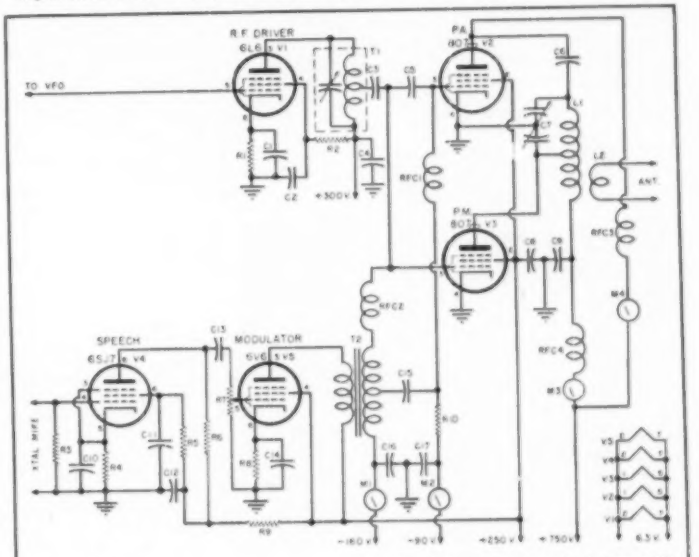


Fig. 1. The r.f. tube plate is shunt-fed and the p.m. plate series-fed to allow use of separate plate current meters. For a diagram of complete unit and an identification of parts see the schematic shown in Fig. 2.

Fig. 2. Circuit diagram and parts list for the super-modulation final amplifier and modulator.



R—250 ohm, 2 w., res.
R—25,000 ohm, 2 w., res.
R—5 megohm, 1 w., res.
R—1500 ohm, 1 w., res.
R—1.5 megohm, 1 w., res.
R—1 megohm, 1 w., res.
R—500,000 ohm pot.
R—500 ohm, 2 w., res.
R—30,000 ohm, 10 w., wirewound res.
R—3000 ohm, 2 w., res.
C_1, C_2, C_3, C_4, C_{12}—.01 μfd., 600 v., cond.
C—250 μμfd., 1200 v., mica cond.
C—100 μμfd., 1200 v., mica cond.
C_5, *C*—.002 μfd., 1200 v., mica cond.
C—50/50 μμfd., split-stator tuning cond., (10 meter operation)
C_{6a}—.01 μfd., 600 v., mica cond.
C_{6b}, C_{13}—.20 μfd., 25 v., elec., cond.
C—8 μfd., 450 v., elec., cond.
C_{9a}, C_{9b}, C_{11}—2 μfd., 600 v., paper cond.

L—4 t., ⅛" copper tubing, 2½" diam., x 3" long (10 meter operation)
L—2 t., ⅛" copper tubing, 2½" diam., x 3" long (10 meter operation)
M, *M*—0-1 ma. d.c. meter
M_3, M_4—0-100 ma. d.c. meter
RFC_1, RFC_2, RFC_3—2½ mh. r.f. choke
RFC_4—10-meter r.f. choke (National R-175)
T—5 t., ☰22 ga., spaced 1¼" long, wound on National FXT fixed exciter tank form
T—Modulation trans., 1-1.5:1 pri., 4000 ohms impedance; sec. 7000 ohms impedance
V_1—6L6 r.f. driver tube
V_2—807 r.f. tube
V_3—807 p.m. tube
V_4—6SJ7 speech amp. tube
V_5—6V6 mod. tube

Note: Final r.f. tube grid and plate tank circuit are wired with ☰10 bus bar.

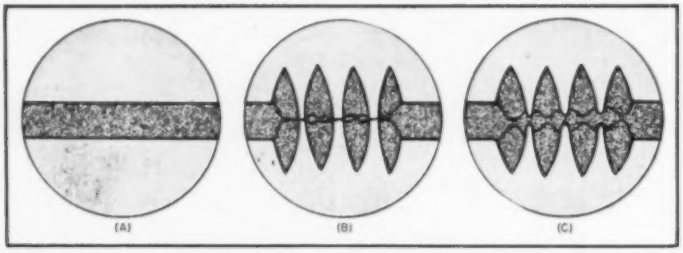


Fig. 3. How r.f. tube drive should be adjusted to prevent carrier clipping yet retain high modulation peaks. (A) Carrier only. (B) overmodulation with clipping. (C) under 100% modulation.

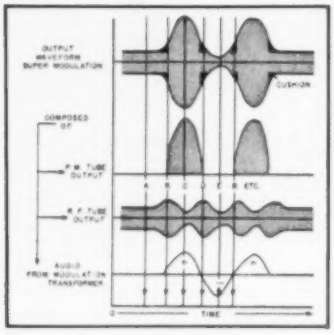


Fig. 4. Graph showing the super-modulated output waveform and its separate components, drawn on a common time base.

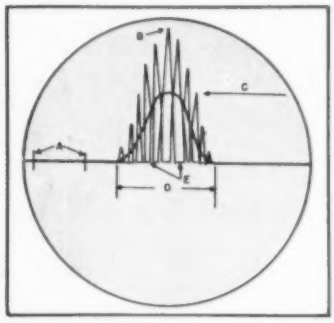


Fig. 5. Panadaptor image showing method for determining relative carrier strength, percent modulation, and bandwidth. Point "A" is 10 kc. marker, "B" voice peak, "C" carrier level, "D" bandwidth, and "E" carrier clipped showing overmodulation. This signal is overmodulated as shown by flattening at "E."

clipped. The carrier has even been suppressed to minimize heterodyne tendencies with other carriers. This is still amplitude modulation, but with greatly extended positive peaks. Fig. 8 is an average NBFM signal with narrow deviation, and no splatter when received on an AM receiver. The amount of voice power is small and even using a discriminator for correct reception results in low audio content because of the small deviation allowable. Wide-band commercial FM stations, of course, are very efficient. NBFM has many advantages, but voice efficiency is low. It is evident that super-modulation delivers far more "talk-power," as Mr. Taylor calls it, than any of the other types of signals shown. Perhaps some day we may report a received signal as: "Fine business OM or coming in 10 db. over 9 on my Panadaptor. Your modulation is about 80% and your bandwidth is 8 kc." This report would give the operator real information.

While operating a super-modulated transmitter some major differences were noted compared to the operation of a conventional plate-modulated AM rig.

1. Using regular AM methods the final r.f. plate meter should not vary with modulation. With super-modulation it should, and does, vary. In fact, they vary, both the r.f. and p.m. tube plate milliammeters. If they don't, you are not modulating.

2. When receiving a regular method AM signal the "S" meter indicates carrier strength. A strong movement of the needle with modulation could indicate overmodulation. With super-modulation a large needle movement is normal, indicating extended positive signal peaks. On one transmission check with super-modulation the "S" meter read S-9 with the carrier only and reached 15 db. over on peaks. "S" meters are relative indicators only and should not be depended upon for accurate measurements.

3. In modulating the usual plate-modulated AM transmitter, an audio power equal to 50% of the r.f. final stage power is required of the modulator. With super-modulation the modulating power is r.f., not audio, and is supplied by the p.m. tube. A comparatively small amount of audio power is sufficient to trigger the p.m. tube into releasing its power into the common final tank circuit.

When receiving super-modulated signals on a conventional receiver equipped with a.v.c. the background noise will tend to rise during periods of reduced carrier. This action will cause no difficulty in the majority of cases unless the carrier suppression is severe. In any event, the turning off of the a.v.c. will result in a much more readable signal when this occurs. It is advisable to try both ways.

I have heard super-modulation referred to as a form of pulse modulation and unlawful for amateurs. Super is definitely amplitude modulation. The word "pulse" could just as readily describe the driving power to a pair of class "B" modulators. One works as much on a pulse basis as the other. Super has been referred to as a form of low-level grid modulation, perhaps as a result of a hasty glance at the schematic diagram. Because the modulation is added to the carrier in the final transmitter stage, this insures its being high level. Although audio is applied to the tube grids, the p.m. tube is not a class "C" amplifier making a constant carrier as would be found in grid modulation systems. The p.m. tube is actually an r.f. modulator and can be thought of as taking the place of the usual class "B" modulators used in regular-method AM transmitters. In conclusion, super-modulation represents real efficiency. The p.m. or modulator tube is dead until you speak. Then it releases r.f. power at an audio rate only half of the time, on the positive audio voltage alternations. On the negative alternations it is cooling. Expensive audio transformers are not required. It's still cheaper to obtain say 100 watts of r.f. power than the same amount of audio power.

—30—

Fig. 6. (A) Unmodulated regular method AM carrier only. (B) Same signal 100% modulated, as seen on Panadaptor screen. Fig. 7. (A) Carrier only, super-modulated signal. (B) Fully modulated "super" as seen on Panadaptor. Notice extended positive peaks and suppressed carrier (lower peak). Fig. 8. (A) NBFM signal without modulation. (B) Same signal modulated ± 3 kc. Notice dead spot at "C."

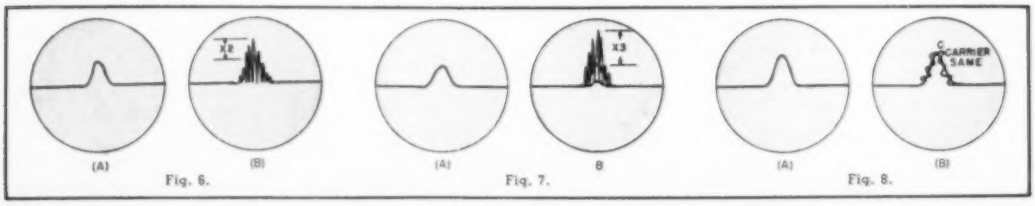


Fig. 6. Fig. 7. Fig. 8.

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A Two-Band Wire

(Continued from page 42)

a simple connector made out of lucite was devised and used as shown in Fig. 3. The antenna was thus assembled, hoisted in the clear about 30 feet above ground and placed in use.

The same principle is applied if the antenna is being constructed for 7.13 mc. and 14.25 mc. operation. For such, however, the "300 ohm common point" is to be noted in Fig. 2 as 22 feet from one end, and the feed line must be connected accordingly. Ten and twenty meters at 11 feet, or twenty and forty meters at 22 feet—take your choice; it can't be both combinations with a single connection.

Upon installation of this antenna at the writer's station, it was noted that regardless of which of the two bands the antenna was used on, the final stage of the transmitter did not detune from minimum plate current state when the antenna was connected to it, thus indicating an excellent impedance match throughout the entire antenna system. In addition, the system loaded very readily as demonstrated by the required loose coupling of the two-turn pickup loop at the final stage of the transmitter.

With a Class B modulated phone transmitter operating at not more than 150 watts input, no trouble has been experienced by the writer and others in working out satisfactorily on the 7, 14, and 28 mc. bands, even during the most congested hours. Surprisingly enough, the antenna seems to be not at all critical as to tuning anywhere within these bands.

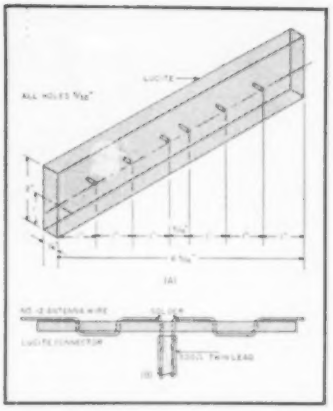

Fig. 3. Method of lacing wire through connector and attaching 300 ohm line.

With the use of a non-resonant feed line as indicated and the absence of standing waves as borne out by test, maximum efficiency in the transfer of energy from the transmitter to the antenna is achieved, and broadcast interference is kept to a minimum. These desirable factors alone should appeal to any amateur, new or experienced, and make construction of this simple antenna system a next-weekend must.

The author's address is 2062 Eudora Street, Denver 7, Colorado. —30—

QUALITY LOSS IN TAPE AND WIRE RECORDERS DUE TO METALLIC DUST

By MATTHEW MANDL

OFTEN tape and wire recorders suddenly develop severe distortion, in conjunction with low output and poor erase qualities. In most instances this trouble is due to an accumulation of metallic dust which has rubbed off the tape or wire as it slides over the surfaces of the recording-erase heads. New reels of tape and new spools of wire are the worst offenders, though prolonged replay or re-recording of older tapes will also result in clogging of the recording and erase heads.

An excellent method for cleaning the tape recorder heads is to use a pipe cleaner or a toothpick with cotton wrapped around its tip. Either of these is dipped into carbon tetrachloride or acetone; then applied to both the recorder and erase heads, repeating with another pipe cleaner or cotton tip if the first one shows evidence of picking up considerable dust residue. Finish with a dry pipe cleaner, or allow the cleaner fluid time to evaporate before running the tape over the heads again. Sometimes the heads need cleaning after only one or two new reels have been run through.

In the case of the wire recorders, the aperture through which the thin wire runs on the recording head is too small to clean properly with a pipe cleaner or cotton-tipped toothpick. A thin piece of string or cotton thread can be used, again dipped in acetone.

Tape recorder heads need more frequent cleaning than wire recorders, because the recording compound on the tape rubs off more easily than metallic dust from wire. Occasionally the heads may clog so much that even acetone cleans it only with great difficulty. This occurs after long use without cleaning, and in this case it may be necessary to scrape off the cakes of recording dust which have adhered to the heads. A thin plastic aligning stick may be used for this purpose, or any other hard, pointed, non-metallic rod. A metal screwdriver or pin is not recommended because it will scratch the surfaces over which the tape rides. A scored and rough surface aggravates the trouble, for the heads will pick up more of the tape coating than before. —30—

Pipe cleaner can be used effectively to clean clogged recording and erase heads.

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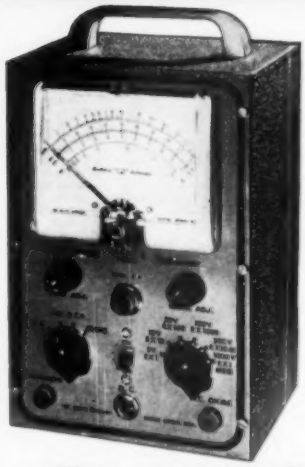

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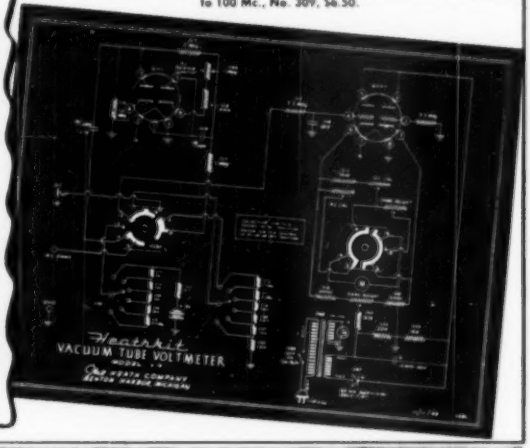

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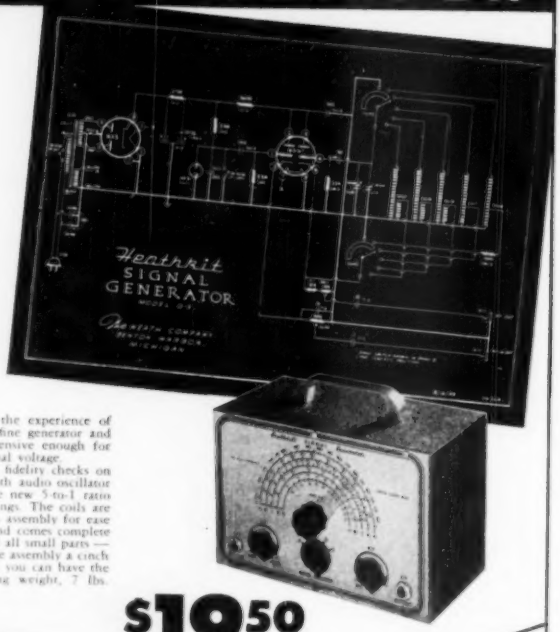

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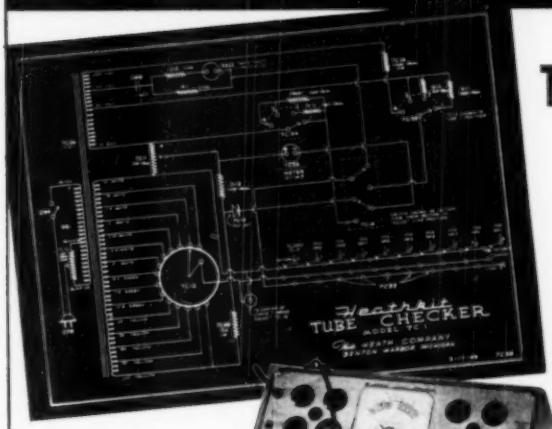

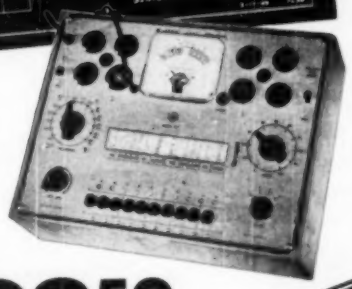

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8. Large size 11" x 14" x 4" complete.
9. Checks new 9 pin miniatures.

Check the features and you will realize that this Heathkit has all the features you want. Speed, simplicity, beauty, protection against obsolescence. The most modern type of tester — measures each element — beautiful Bad-Good scale, high quality meter — the best of parts — rugged oversize 110V, 60 cycle power transformer — finest of Mallory switches — Centralab controls — quality wood cabinet — complete set of sockets for all type tubes including blank spare for future types — fast action gear driven roller chart uses brass gears to quickly locate and set up any type tube. Simplified switching cuts necessary time to minimum and saves valuable service time. Short and open element check. No matter what arrangement of tube elements, the Heathkit flexible switching arrangement easily handles it. Order your Heathkit Tube Checker today. See for yourself that Heath again saves you two-thirds and yet retains all the quality — this tube checker will pay for itself in a few weeks — better build it now.

Complete with detailed instructions, all parts, cabinet, roller chart, ready to wire up and operate. Shipping weight, 12 lbs. Model TC-1.

Only $29.50

$22.50

Heathkit BATTERY ELIMINATOR KIT

Now a bench 6 Volt power supply kit for all auto radio testing. Supplies 5 - 7½ Volts at 10 Amperes continuous or 15 Amperes intermittent. A well filtered rugged power supply, uses heavy duty selenium rectifier, choke input filter with 4,000 MFD of electrolytic filter. 0 - 15 Volt meter indicates output. Output variable in eight steps. Excellent for demonstrating auto radios. Ideal for servicing — can be lowered to find sticky vibrators or stepped up to equivalent of generator overload — easily constructed in less than two hours. Complete in every respect. Shipping wgt., 19 lbs.

Model BE-1

Nothing ELSE TO BUY

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13 East 40th St.
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The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

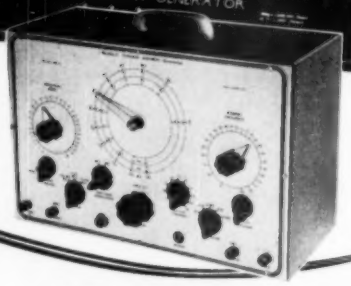
Heathkits ELIMINATE

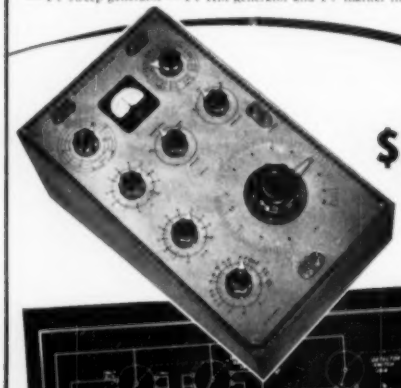
Heathkit TELEVISION ALIGNMENT GENERATOR KIT

Everything you want in a television alignment generator. A wide band sweep generator covering all TV frequencies 0 to 46 — 54 to 100 — 174 to 220 Megacycles, a marker indicator covering 19 to 42 Megacycles, AM modulation for RF alignment — variable calibrated sweep width 0-50 Mc. — mechanical driven inductive sweep. Husky 110V. 60 cycle power transformer operated — step type output attenuator with 10,000 to 1 range — high output on all ranges — band switching for each range — vernier driven main calibrated dial with over 45 inches of calibration — vernier driven calibrated indicator marker tuning. Large grey crackle cabinet 16⅛" x 10⅝" x 7-3/16". Phase control for single trace adjustment. Uses three high frequency triodes plus 5Y3 rectifier — split stator tuning condensers for greater efficiency and accuracy at high frequencies — this Heathkit is complete and adequate for every alignment need and is supplied with every part — cabinet, calibrated panel, all coils and condensers wound, calibrated and adjusted, tubes, transformer, test leads — every part with instruction manual for assembly and use. Actually three instrumenes in one — TV sweep generator — TV AM generator and TV marker indicator.

$39.50

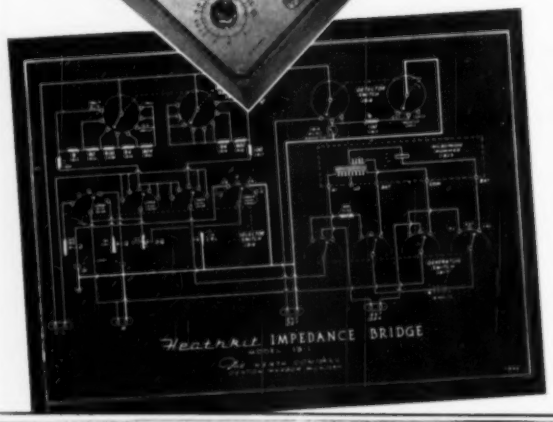
Shipping weight 20 lbs.
Model TS-1A





$69.50

Shipping weight 15 lbs.
Model IB-1



New Heathkit IMPEDANCE BRIDGE KIT

A LABORATORY INSTRUMENT NOW WITHIN THE PRICE RANGE OF ALL

Measures inductance from 10 microhenries to 100 henries capacitance from .00001 MFD. to 100 MFD. Resistance from .01 ohms to 10 megohms. Dissipation factor from .001 to 1. "Q" from 1 to 1000.

Ideal for schools, laboratories, service shops, serious experimenters.

An impedance bridge for everyone — the most useful instrument of all, which heretofore has been out of the price range of serious experimenters and service shops. Now at the lowest price possible. All highest quality parts. General Radio main calibrated control. General Radio 1000 cycle hummer. Mallory ceramic switches with 60 degree indexing — 200 microamp zero center galvanometer — ½ of 1% ceramic non-inductive decade resistors. Professional type binding posts with standard ¾" centers. Beautiful birch cabinet. Directly calibrated "Q" and dissipation factor scales. Ready calibrated capacity and inductance standards of Silver Mica, accurate to ½ of 1% and with dissipation factors of less than 50 parts in one million. Provisions on panel for external generator and detector. Measure all your unknowns the way laboratories do — with a bridge for accuracy and speed.

Internal 6 Volt battery for resistance and hummer operation. Circuit utilizes Wheatstone, Hay and Maxwell circuits for different measuremenes. Supplied complete with every quality part — all calibrations completed and instruction manual for assembly and use. Deliveries are limited.

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DIFFICULT METAL FABRICATION....

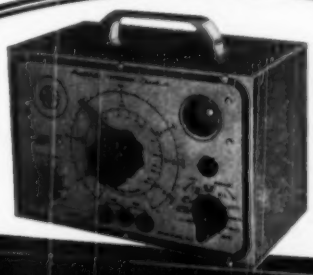
NEW *Heathkit*

SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

The popular Heathkit Signal Tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker, locates intermittents, defective parts quicker, saves valuable service time, gives greater income per service hour. Works equally well on broadcast, FM or TV receivers. The test speaker has assortment of switching ranges to match push-pull or single output impedance. Also tests microphones, pickups, PA systems; comes complete — cabinet, 110V. 60 cycle power transformer, tubes, test probe — all parts and detailed instructions for assembly and use. Shipping Wt., 8 lbs. Model T-2.

$19.50

Nothing ELSE TO BUY



$19.50

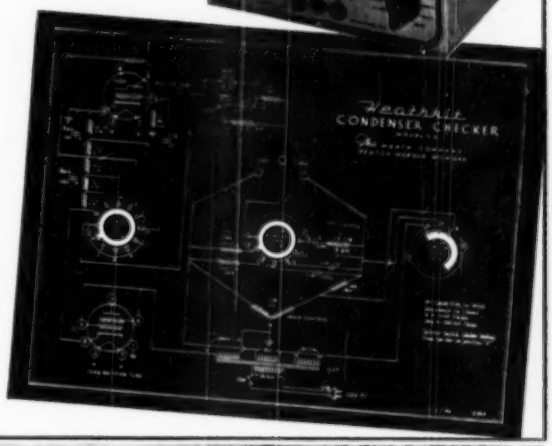
Heathkit

CONDENSER CHECKER KIT

Features

- Power factor scale
- Measures resistance
- Measures leakage
- Checks paper-mica-electrolytics
- Bridge type circuit
- Magic eye indicator
- 110V. transformer operated
- All scales on panel

Checks all types of condensers, paper-mica-electrolytic-ceramic over a range of .00001 MFD. to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage for 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instruction for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill. Shipping weight, 7 lbs. Model C-2.



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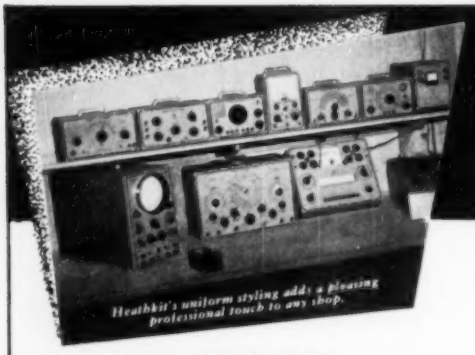
... BENTON HARBOR 15, MICHIGAN



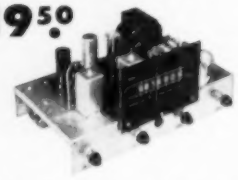
Heathkits PROVIDE PROFESSIONAL LABORATORY APPEARANCE

New Heathkit BROADCAST AND 3 BAND SUPERHETERODYNE RECEIVER KIT

Two new Heathkit Superheterodynes featuring the best of design and material. Beautiful six inch slide rule dials — 110 V. 60 cy. AC power transformer operated — metal cased filters — quality output transformers, dual iron core metal can IF transformers — two gang tuning condenser. The chassis is provided with phono-radio switch — 110 V. outlet for changer motor and phono pickup jack. Each kit is complete with all parts and detailed instruction booklet. Pictorial diagrams and step-by-step instructions make assembly quick and easy.

BROADCAST MODEL BR-1
550 to 1600 Kc.

$19.50



Ideal AC operated superheterodyne receiver for home use or replacement in console cabinet. Comes complete with attractive metal panel for cabinet mounting. Modern circuit uses 12K8 converter, 12SH7 input IF stage, 12C8 output IF stage and first audio 12A6 beam power output stage, 5Y3 rectifier. Excellent sensitivity for distant reception with selectivity which effectively separates adjacent stations.

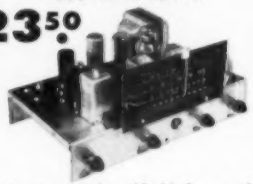
The husky 110 V. cased power transformer is conservatively rated for long life.

The illuminated six inch slide rule dial is accurately calibrated for DX reception. Enjoy the pleasure of assembling your own fine home receiver. Has tone, volume, tuning and phono-radio controls. Chassis size 2¼" x 7" x 12½". Comes complete with all parts including quality output transformer to 3-4 ohm voice coil, tubes, instruction manual, etc. (less speaker). Shipping Wt., 10 lbs. No. BR-1 Receiver $19.50.

No. 535 Communications Type Table Model Metal Cabinet **$4.50**
No. 520 High Quality 5" PM Speaker for above **2.75**

3 BAND MODEL AR-1
550 Kc. to 20 Mc.

$23.50



Enjoy the thrill of world wide short wave reception with this fine new AC operated Heathkit 3 band superheterodyne — amazing sensitivity 15 microvolt or better on all bands. Continuous coverage 550 Kc. to over 20 Mc. Easy to build with complete step-by-step instructions and pictorial diagram. Attractive accurately calibrated six inch slide rule dial for easy tuning. Six tubes with one dual purpose tube gives seven tube performance. Beam power output tube gives over 3 watts output.

Separately assembled coil turret with band switch eliminates difficult construction. Conservatively rated 110 V. power transformer supplies full operating voltages to all tubes for maximum reception. Has band switch, tuning, volume, tone and phono-radio controls. Chassis size 2¼" x 7" x 12½" — supplied complete — punched chassis — tubes — controls — transformers (quality output to 3-4 ohm voice coil) — all small parts — hardware and instructions (less speaker). Shipping Wt., 10 lbs. No. AR-1 Receiver $23.50.

No. 535 Communications Type Table Model Metal Cabinet **$4.50**
No. 520 High Quality 5" PM Speaker for above **2.75**

Heathkit PUSH-PULL HIGH FIDELITY AMPLIFIER KIT

$12.50

Build this high fidelity push-pull amplifier and save two-thirds the cost — has two pre-amplifier stages, phase inverter stage and push-pull beam power output stage. Comes complete with six tubes — quality output transformer (to 3-4 ohm voice coil) tone and volume controls — varnish impregnated cased 110V. power transformer and detailed instruction manual and all small parts. Six watt output with output flat within 1½ db between 50 and 15000 cycles.

Build this amplifier now and enjoy it for years.

Shipping Wt. 7 lbs. Model A-4
12" PM Speaker for above **$6.95**

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BENTON HARBOR
MICHIGAN

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___Express
___Freight
___Best Way

Quan.	DESCRIPTION	Price	Total

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What's New in Radio

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page, and the issue number, delay will be avoided.

CONVERTER LINE

A new line of d.c. to a.c. converters has been announced by *Cornell-Dubilier Electric Corporation* of South Plainfield, New Jersey.

These "Powercons" have been designed for use with radio or television

equipment and are filtered for clear reception. They are capable of starting under full load without the necessity of starting the converter first and then applying the load. Several of the 32 and 110 volt models include the company's "Phantomswitch" circuit for automatic starting and stopping when the a.c. load switch is operated.

A dozen different models of converters are available ranging from units capable of operating from a 6 volt battery source to units capable of converting 110 volt d.c. to operate television receivers in d.c. urban areas. Complete data and further information are available from the company.

FILM SYNCHRONIZER

The *Amplifier Corp. of America*, 398-2 Broadway, New York 13, New York, has developed a simple and efficient system for synchronizing a mag-

netic tape recorded script with any automatic slide projector without the use of tone signals or push-buttons.

A high-fidelity "Twin-Trax" dual-channel tape recorder is used as the recording and playback medium. At pre-set intervals, a pulse is sent to the projector, activating the projector's tripping mechanism. A pair of leads from the recorder to the projector is the only electrical or mechanical connection required.

The script is recorded in the normal manner on sound recording tape. At each point in the script where the slide is to be changed, a 2" long, ⅛" wide strip of special self-adhering copper foil is placed on the back, or uncoated side, of the recording tape. As the recording tape passes a laminated switch on the recorder during playback, the copper foil shorts out a section of the switch which activates a relay to send the tripping pulse to the projector.

Full details and operating specifications on this film synchronizer are available from the company's Audio-Visual Division.

S.W. CONVERTER

A new auto radio short-wave converter that makes reception possible

on all makes and models of auto radios has just been announced by *Philco International Corporation* of 50 Broadway, New York 4, New York.

The short-wave converter, Model SW-4940, features six push-buttons that provide for the instantaneous selection of 49 meter, 31 meter, 25 meter, 19 meter, 16 meter, and standard broadcast bands.

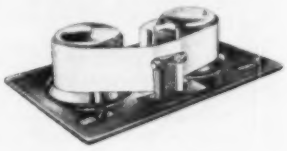
The unit mounts compactly under the dashboard. It uses two miniature tubes and has a fixed-tuned r.f. stage.

TAPE RECORDER

National Recorder Co. of 7120 Melrose Avenue, Los Angeles 46, California has developed a new tape recorder which provides two hours of recording time (at 7.5 inches per second) instead of the customary one hour's recording. The unit operates on a new patented principle which eliminates the rewinding of tape before playback.

Instead of using the conventional ¼ inch tape, the new recorder uses a

tape two inches in width. The wide tape allows the recording of twelve tracks per inch instead of one per quarter inch. This feature utilizes the maximum amount of tape possible while cutting waste tape surface to a minimum. Upon reaching the end of the tape, the recording head drops



down one track and the tape reverses, giving continuous recording in the opposite direction. The time cycle for this operation is 1/60th second.

"ELECTRONIC BLACKBOARD"

As an aid in teaching television and electronics courses, *Television Equipment Corporation* of 238 William Street, New York 7, New York has announced a new "Electronic Blackboard."

The new T-602 projection oscilloscope delivers pictures either 18 x 24

inches for small groups or 8 x 10 feet for larger audiences. The light-gathering power of its *Bausch & Lomb* refractive optical system is said to provide the largest, brightest cathode-ray tube display now commercially available.

Particular new features including functional centering controls, improved calibration circuit, driven and recurrent sweeps, line frequency deflection and phasing, as well as novel brightening and Z-axis intensity circuits increase the basic usefulness of the T-602.

REPLACEMENT CONTROLS

A packaged set of specially designed parts, tradenamed "Concentrikit" is being marketed by *International Resistance Co.* of 401 N. Broad Street, Philadelphia 8, Pa.

From this kit, radio technicians are enabled to assemble a variety of concentrics to meet over an estimated 90 per-cent of their replacement require-

(Continued on page 118)

hallicrafters

S-56 11-TUBE FM-AM CUSTOM CHASSIS. A REGULAR $110.00 VALUE ON SALE AT McGEE FOR $59.95

A World's Finest Radio Value for Custom Installation

S-56 with 12" Coaxial speaker as pictured $69.95

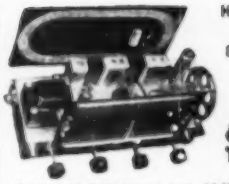
Model S-56 Hallicrafters, 11 tube AM-FM radio receiver chassis for broadcast and FM, 88 to 108 mc. Automatic frequency control on FM, holds the receiver in perfect tune. Phono connection on rear of chassis. Full range tone control with bass boost. Push-pull 6K6 tubes in audio system. Frequency response essentially flat, from 50 to 14,000 CPS. Wide vision accurately calibrated slide rule dial, with pilot-selection on broadcast band. Output transformer matches any 8 ohm speaker. 4 antenna terminals, two for AM and two for FM. This is the finest type of home radio that we know of today. Better get your order in early. Designed to be used in commercial radio selling in the $400 to $600 class. The regular dealer net on this chassis is $110.00. However, a lucky purchase enables us to offer these brand new, factory cartoned S-56 Hallicrafters chassis, complete with tubes and operating instructions, at only $59.95 less speaker. Chassis size 12¾x11⅞x7¾. Weight 25 lbs. Brand new, factory cartoned. Buy your S-56 with a wide range FM speaker. Pick your combination from the prices listed below and save.

S-56 Hallicrafters custom chassis with tubes and operating instructions and 12" 20 watt coaxial PM, $12.95 value. Net, ready to play as pictured above. Shipping weight 33 lbs. Net, $69.95.

S-56 Hallicrafters custom chassis with tubes and operating instructions and super 12" 25 watt Alnico V PM speaker, ready to play. Shipping weight 38 lbs. Net, $69.99.

S-56 Hallicrafters custom chassis with tubes and operating instructions and 15" 21 oz. speaker Model Alnico V PM speaker, ready to play. Shipping weight 45 lbs. Net, $73.95.

Order the VM-406 3-speed record changer, shown below at $33.21, or the General Instrument single speed changer at $12.95, with your S-56 Hallicrafters.



HALLICRAFTERS S-59 8-TUBE FM-AM CUSTOM CHASSIS

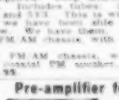
$32.95

Model S-59 Hallicrafters, high selectivity 8 tube FM-AM chassis, for custom installation. Receives broadcast 540 to 1700 kc and FM 88 to 108 mc. Size 12¾x7¾x7. An excellently engineered chassis, with accurately calibrated slide rule dial. Variable tone control and 30 to 14,000 CPS wide range audio. Push-pull 6K6 s. 8 ohm output transformer will match most speakers. No special output transformer required. Loop antenna built in for broadcast reception. Includes tubes: 2-6BA6, 6H6, 6AL5, 6SQ7, 2-6K6 and 6X4. Complete with tubes and operating instructions. Radio chassis we have been able to offer better than ever before. Order now. We have only a few left.

S-59, 8 tube chassis with tubes. Weight 18 lbs. Net $32.95.

S-59, 8 tube FM-AM chassis, with tubes and regular $12.95, 12" coaxial PM speaker, CR-14X. Weight 28 lbs. Net $42.95.

Pre-amplifier for S-56 and S-59



$3.95

Dual purpose preamplifier for either S-56 or S-59. Only 4 wires to connect (instructions furnished). With this you can convert set to operate either a G.E. variable reluctance pick-up or a crystal or ceramic type record player to S-56 or S-59's home P.A. system. Preamp Model 88-606. Size 3½x4x2". Shipping weight 1 lbs. Net price $3.95. Crystal mike and desk stand $4.95 extra.

COMPLETE RADIO AND AMPLIFIER KITS BEST QUALITY AND PRICES

6-TUBE AC 2 BAND RADIO KIT $9.95

BIGGEST RADIO KIT VALUE IN U. S.

BUILD A RADIO WITH MATCHED "DETROLA" PARTS

A complete kit of parts, tubes and ready punched chassis to build a fine 6 tube power transformer type radio chassis. (No cabinet.) We furnish every piece as well as a printed diagram and photograph. Chassis size 14 x 7½ x 7. Receives standard broadcast and 6 to 18 MC foreign short wave. 3 gang tuning condenser used on both bands. 90 mil power transformer 6v6 output tube. This kit is made up of parts intended for use in a high quality Detrola radio. Has full lighted slide rule dial. Everything goes together just like a factory built radio. Printed, complete with 6 tubes. Kit model 6-ACX. Less speaker. Weight 16 lbs. Net $9.95.

CHOICE OF EITHER 8 OR 10 INCH DYNAMIC SPEAKER, $1.99 EXTRA. NOTE OUTPUT TRANSFORMER IS ATTACHED TO THE SPEAKER.

DETROLA—SCOOP COILS, GANG, DIAL, PAN $2.95

Detrola Coil, pan, condenser scoop. Material from the Detrola radio plant makes this unusual offer possible. We furnish you the punched chassis pan, 3 gang condenser with proper slide rule dial assembled, and etched dial, pair of I.F.'s, matched coils and band switch for broadcast and foreign shortwave. You furnish your own tubes, resistors, condensers and speaker. Suggested schematic for you to follow. Worth $10.00. Shipping weight 9 lbs. Stock No. DET-1. Not only $2.95.

New 3-Way PORTABLE RADIO KIT ONLY $9.95

Sensational new 3-way portable P.R.K.10 kit, 4 tubes plus rectifier. Housed in an all aluminum, leatherette covered case made by Farnsworth, w.15.5 loop antenna built-in size 9x8x6". Build yourself a professional looking radio with this kit. Every piece furnished including tubes: 1R5, 1T4, 1S5, and 3V4, as well as easy-to-follow diagram and photo. This set will make a full range radio that looks like a $40.00 radio. We should ask $17.50 for this kit. Complete kit less tubes, weight 8 lbs. Net price $9.95. Kit of 4 batteries, 67½ volt "B" and "A" $2.25 extra.

CAROD PERSONAL PORTABLE KIT

Complete Carod personal portable K.15. Model X-45. Made from genuine Carod factory matched parts. A complete kit to build a 5-tube battery-operated 4-tube receiver, small in size, 8½x3½x4½". Weight 3½ lbs. Shipping weight 6 lbs. Set comes in white 101 prints. Rugged metal case with colored plastic front and back. Loop antenna is 3rd. Furnished with diagram, photos and tubes. Easy to build superhet. Has built-in flashlight well. $1.69 extra. Will go together like a factory built radio. Shipping weight 6 lbs. Model X-45. Net price $9.95.

Model X-45PT portable radio is X-45 wired and ready to operate. Net, $14.95.

3-SPEED RECORD PLAYER KIT $16.95

New 3-speed portable record player kit, housed in the attractive Capitol portable case. Has 33⅓, 74 and 45 RPM phono motor with 2 speed, 2-pick-up arm, with needles. Almico PM speaker and all components for 4 tubes to build AC-DC type amplifier, with separate tone and volume control. Kit Model 3-PK. Complete with wiring instructions. Weight 16 lbs.

McGEE'S NEW FM-AM-PA KIT $39.95

12 Tube Kit Model PRK-51. This is the most elaborate radio-P.A. kit that our engineering department could design. Here is features: Receives broadcast, 550 to 1650 kc and FM, 88 to 108 mc. 3 gang tuning on FM. Audio system is wide range 40 to 17,000 cps., 5 tr. interwound high fidelity output matches 8 ohm speaker. Tru-tone controls, bass and treble boost. Phonograph inputs for standard crystal or General Electric variable reluctance. Mike input for crystal mike. This radio can also be used for an 18 watt P.A. system, a recording amplifier, or for a high fidelity TV sound system. Chassis punched and etched. Everything furnished with the kit, including tubes: 6AG5, 6SH7, 2-6BA6, 6AT6, 6U6, 6BE6, 2-12AT7, 2-6V6 and 5V4. The FM tuning unit is ready wired. To make this kit easier for you to build, a 6" slide rule dial. Complete kit model PRK-51, with photos and instructions, $39.95. Speaker recommended, Oxford 12", 22 oz. FM, curved cone and 15" 3-400 Alnico V PM, $16.95 extra.

12 WATT PORTABLE AMP KIT $12.95

This amplifier kit, when wired may be used as a musical amplifier, paging system or for any other low power P.A. use. It is a complete kit with drilled, ready punched chassis and matched parts to build an AC transformer type amplifier with push-pull output tubes. 2 watts in heavy duty 6 oz. Alnico V PM speaker. With 12AX7, 2-6AQ5 and 6X4. Inputs for two instruments or mike and phono pickup. Leatherette covered case. MM-12B crystal mike. Net weight 18 lbs. Net $12.95. Crystal mike and desk stand $4.95 extra. Musical contact mike, small rubber case. Just place on instrument and pickup music without removing it. Model MM-12B. Net $5.95. WC-2B. Net $5.95.

6-TUBE AC-DC KIT $11.95 5-TUBE MODEL $9.95

Motor's New 1950 Model 6-tube AC-DC superhet radio kit, complete with all matched parts. Attractive plastic cabinet, full 2-gang superhet circuit with 456 I.F.'s, AVC, full wave dynamic speaker, illuminated slide rule dial and loop antenna. Every part included including tubes and schematic diagram. This kit is ideal for schools and training use. Will make a commercial looking radio when wired. 6-tube kit, Model 5BC6, with 6 tubes: 2-12BA6, 12BE6, 12AT6, 12B5, and 35W4. Shipping weight 8 lbs. Net price $11.95.

5-tube kit, Model 5BC5, same as above only does not have RF stage, with 5 tubes. Shipping weight 7 lbs. Net price, $9.95.

6-110 VOLT POWER SUPPLY KIT, $14.95

New utility power supply kit, works on either a 6 volt storage battery or 110 volts AC. Furnishes power for a 25 watt amplifier (135 mils B and 6.3 volts). Has built-in vibrator (110 volts AC at 25 watts) from a storage battery. Kit No. KB complete with diagram. $14.95. 6-110, 50 to cycle vibrator only $7.95. Thordarson 6-110 power transformer, $5.95.

SOLAR F.P. COND. SALE

40-30	Mfd	150v	FP cond	1	x2"	$.29
40-40	Mfd	150v	FP cond	1	x2½"	.29
40-40	Mfd	150v	FP cond	1	x3"	.39
30-50	Mfd	150v, 20-150v				
				100	10¢	11x2"	.49
40-40	Mfd	150v				
				40-40	25v	11x2"	.39
50-50	Mfd	150v	20	25v	11x2"	.39
60-40	Mfd	150v	20	25v	11x3"	.49
75-75	Mfd	150v	FP cond	1	x3"	.59
40	Mfd	150v	FP cond	1	11x2"	.49
50	3000v, 40	250v,				
				20	25v	1	x3"	.49
10-15	Mfd	150v	20	25v	1	x2½"	.49
20	Mfd	400v	20	25v	1	x2½"	.39
40-10	Mfd	450v	FP cond	1	x2½"	.49
8	Mfd	450v	FP cond	1	x2"	.34
10	Mfd	450v	FP cond	1	x2"	.29
16	Mfd	450v	FP cond	1	x2"	.34
20	Mfd	450v	FP cond	1	x2"	.34
30	Mfd	450v, 20-25v				
				25v	1	x3"	.39
8-8	Mfd	450v	FP cond	1	x3"	.34
10-15	Mfd	450v	FP cond	1	x2½"	.49
15-15	Mfd	450v	FP cond	1	x3"	.59
20-10	Mfd	450v	25v	1	x3"	.59
30-15-10	Mfd	450v,				
				20	25v	1	x3"	.69
20	Mfd	525v	FP cond	1	x3"	.49

ALUMINUM TUBULAR—ELECTROLYTICS NEW PRODUCTION

Made by a nationally known condenser factory. Brand new, current production stock. All guaranteed for one year. Metal tubular cases, sealed ends, solid leads and paper insulating sleeves. These six types fill most of your condenser needs.

Stock No.					
MN-8	8	Mfd	450	volt cond.	$0.29
MN-10	10	Mfd	150	volt cond.	.29
MN-20	20	Mfd	150	volt cond.	.29
MN-40	40	Mfd	150	volt cond.	.39
MN-20-20	20-20	Mfd	150	volt cond.	.39
MN-55	50-50	Mfd	150	volt cond.	.49

600 VOLT PLASTICS

Molded plastic 600 volt by-pass condensers. Made by Sangamo, well known manufacturer. For one year. All first quality.

.001	volt	.06¢	10c each .05
600 volt, 11c, 1.6 for 12c. Order 100 assorted and take 10% off.			

600 VOLT BY-PASSES

Manufacturers' pack of replacement 600 volt tubular by-pass condensers. Best quality. Ask for FV and AC-DC sets. Each will take the heat.

.01	600 volt,	$0.06;	.05 600 volt, $0.07
.02	600 volt,	.06;	.1 600 volt, .08
100 assorted for $6.95.			

SALE ON RECORDING WIRE

Top quality recording wire on metal spools. Fits Brush, Soundmirror, Webster.

15 minute spool	$1.19 each, 10 for	$11.00
30 minute spool	1.79 each, 10 for	16.00
60 minute spool	2.79 each, 10 for	25.00
Empty metal spools	.25 each, 10 for	2.25

ST. GEORGE WIRE RECORDER MECHANISM $22.95

St. George wire recorder mechanism. Brand new, complete wire recording and playback mechanism. Also plays 78 RPM records when crystal pick-up is installed. Plays 4 hours on 1 hour model. Wonderful wire recorder. Furnished with diagram for 3-tube converter (plans radio or amplifier for wire recording). $.95 extra. Webster model 70 crystal pick-up for 78 RPM records. Net, $22.95. Crystal pick-up for playing our recording phono cuts, $1.95 extra. Wire, 5000 feet, 1 hour, $4.95. 15 min. 1.39. Crystal mike and desk stand, $4.95 extra.

WIRE RECORDER CONVERTER $12.95. With this 3-tube converter you can adapt the St. George Airking, or Webster Chicago wire recorder mechanism to any radio or P.A. system. Only 4 wires necessary. Just plug in to the phone input of your amplifier and connect to plate of output tube. AC-Transformer construction, good for mike, reception switch for quickly changing from record to play-back. Priced really wired and tested with instructions and tube 12AT7 preamplifier, 6AQ5 rectifier, 6X4 rectifier. Stock No. BB-Y. Net, $12.95.

St. George wire recorder mechanism, as pictured above, only cleaned and repairable. Any good technician can put these back in order. Stock No. SG-1. Net price $12.95.

SOLAR F.P. COND. SALE

40-30	Mfd	150v	FP cond	1	x2"	$.29
40-40	Mfd	150v	FP cond	1	x2½"	.29
40-40	Mfd	150v	FP cond	1	x3"	.39
30-50	Mfd	150v, 20-150v				
				100	10¢	11x2"	.49
40-40	Mfd	150v				
				40-40	25v	11x2"	.39
50-50	Mfd	150v	20	25v	11x2"	.39
60-40	Mfd	150v	20	25v	11x3"	.49
75-75	Mfd	150v	FP cond	1	x3"	.59
40	Mfd	150v	FP cond	1	11x2"	.49
50	3000v, 40	250v,				
				20	25v	1	x3"	.49
10-15	Mfd	150v	20	25v	1	x2½"	.49
20	Mfd	400v	20	25v	1	x2½"	.39
40-10	Mfd	450v	FP cond	1	x2½"	.49
8	Mfd	450v	FP cond	1	x2"	.34
10	Mfd	450v	FP cond	1	x2"	.29
16	Mfd	450v	FP cond	1	x2"	.34
20	Mfd	450v	FP cond	1	x2"	.34
30	Mfd	450v, 20-25v				
				25v	1	x3"	.39
8-8	Mfd	450v	FP cond	1	x3"	.34
10-15	Mfd	450v	FP cond	1	x2½"	.49
15-15	Mfd	450v	FP cond	1	x3"	.59
20-10	Mfd	450v	25v	1	x3"	.59
30-15-10	Mfd	450v,				
				20	25v	1	x3"	.69
20	Mfd	525v	FP cond	1	x3"	.49

McGEE'S FEB. SPECIAL— 20 VIDEO COILS AND SARKES TUNER $14.95

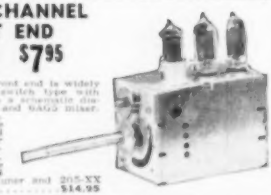
TELEVISION VIDEO COIL KIT—20 MATCHED COILS FOR PICTURE AND SEPARATE SOUND I. F. $7.95

20 matched TV coils; video and sound I.F. McGee Scoop price $7.95. Television video coil kit, for TV sets up to 16", using separate sound and picture circuits. Consists of 20 coils for use in the nationally famous 20 tube and 22 tube TV circuits. All coils are of the finest construction, furnished to you, just like they go to a TV set maker. Each coil is identified. These are not made to RCA, but by a top quality coil company, especially for McGee. If you are going to use the RCA circuit, you can use this set of coils.

Coil kit has 1-180 uh, 1-250 uh, 2-120 uh, 2-93 uh peaking coils, 4 picture IF coils for 21.75 mc, 1 cathode trap, 2 sound IF's 21.25 mc, 1 discriminator, 1 converter and 5 filament chokes. Stock No. 205-XX, shipping weight 3 lbs. McGee's sale price $7.95. These coils match the Sarkes-Tarzain TV front end listed below. Why not order both the tuner and the coils.

SARKES-TARZAIN 13 CHANNEL TELEVISION FRONT END

With Tubes and Diagram $79.95



This popular Sarkes-Tarzain television front end is widely used today. The 13 channel rotary switch type with individually tuned coils. Price includes a schematic diagram and 3 tubes, 6C4 one, 6BH6 RF and 6AG5 mixer. Regular factory cost is twice our price.

Each tuner and the coil strip tube sockets are wired, ready to hook up to a video and sound IF strip. May be used with either interrarier or separate sound IF circuits. Built in fine frequency tested. Ship. weight 3 lbs. Sarkes-Tarzain type 2 TV tuner with tubes net $7.95

Combination deal, Sarkes-Tarzain TV tuner and video coil kit both for 205-XX $14.95

10" TV CABINET $5.95

Stock No. RY-10

Buy this 10" streamlined mahogany television cabinet at less than cost of manufacture. Originally intended for use with the Farnsworth GVZ-60 television chassis, pictured in the lower left. Has grille cloth to fit. Built-in safety shield in front. All new, size 13x18¾x17" high. Shipping weight 35 pounds. **Stock No. RY-10. Net $5.95.** Order this cabinet by itself or order in combination deal.

Sarkes-Tarzain Tuner and Video coil kit can be used with Farnsworth cabinet and chassis, some revamping is necessary.

FARNSWORTH Partially Built-Up CHASSIS $29.95

Stock No. GVZ-60

Buy Both RY-10 Cabinet and GVZ Chassis for $7.95

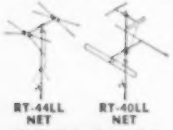
Farnsworth Television Chassis Model GVZ-60 partially built-up Chassis Size 12x15. Has 10 tube sockets and over 100 small parts Resistor and Ceramic Condensators to complete. Important or limiting units, sound and sync, circuits are all partially wired up. The TV Chassis is ideal for the set builder and experimenter. Learn TV by building this very own set, using this chassis to start from. Furnished with a 1945 regular $1.00 Supreme Publications Television Manual which has a complete schematic of this chassis as well as 8 pages of service information for Farnsworth GVZ-60 partially built-up Chassis and 48 Supreme TV Manual all for $5.95

Total postage for 11 lbs. GVZ-60 Chassis only $2.95.

T.V. BOOSTER—REGENCY—$17.61 ANCHOR—$22.05

Regency DB-213 low and high band television booster. Dual 6J6 tubes with iron core push pull RF amplification. For either 75 of 300 ohm inputs. With booster off, Ant. is connected direct to receiver. Weight 5 lbs. Net **$17.61**

Anchor Model ARC-101-SD. Ever popular low and high band TV booster. Carefully engineered and finely constructed. Ship. weight, 6 lbs. Net $22.05



RT-44LL NET $6.75

RT-40LL NET $6.44

TELEVISION ANTENNAS—ON SALE

Television Antennas. Best prices. Top quality. It's Motor for T.V. Corner Model RT-44LL as pictured with 8 foot mast, bracket and foot mount. Dealers net $6.75. Central element for tuning. To the above antenna, same as above antenna but less mast. Net $4.68

Matching Lumber parts ..... 90c per pair

Hi-Low folded dipole with reflector as pictured. With 8 foot mast, bracket and foot. This is the ever popular model for metropolitan reception.

Stock No. RT-40LL. Net $6.44

Central folded dipole with reflector, 8 foot mast, bracket and foot mount.

Stock No. RT-42LL. Net $1.25

Hi-Lo band folded dipole element with reflector for stacking in three antenna.

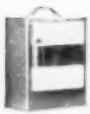
Stock No. RT-52. Net $1.49

Stacking lumber bars ..... 90c per pair

Twin lead 300 ohm feed transmission line, top quality. 4 foot net $1.49. 100 feet for $9.95

Federal 300 ohm shielded twin transmission line K-111. 100 feet for $11.25

1000 feet for $105.00



MUSICAL P.A. 34-WATT $54.95

Musical P.A. amplifier $54.95. Powerful 34 watt, wide range musical P.A. amplifier in attractive leatherette covered cabinet, with speaker grille to front. 12" super heavy duty Oxford curvilinear speaker and Alnico V PM speaker. This speaker is used by others on their highest priced amplifiers. Response from 40 to 17,000 cps. 3 inputs, 2 for mixed microphones or mikes, one for crystal pick-up. Tone compensation for G.E. variable reluctance pick up. Push-pull 6L6G output tubes, twin tone controls and inverse feedback. This amplifier may be used for two instruments or two mikes. If is the most versatile amplifier that we know of. Stock No. MM-35, complete ready to operate. Weight 26 lbs. Net price, $54.95.

WIRE RECORDER P. A. SYSTEM $69.95

18 Watt wire recorder and Public Address system with 12 in. heavy duty PM speaker. Records and plays, mike and phono or radio tuner. Equipped with a 6K variable speed motor, for up to record from 78 r.p.m. phono records. Amplifier is 18 watts output from AC power transformer type. Built in erase circuits. A complete unit ready for operate. Stock No. GE-16. Ship. weight 58 lbs. Net $69.95

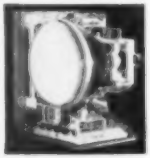
Crystal mike and desk stand $4.95 extra.

Recording wire, 15, 30 and 60 min. spools $1.19, $1.79 and $2.79.

NATIONALLY FAMOUS 15-INCH CUSTOM CHASSIS WITH PICTURE TUBE

Regularly $250.00

McGEE'S SCOOP PRICE $169.95



McGee does it again. We bought 150 of this nationally advertised brand, 23 tube television chassis. We are withholding the manufacturer's name as their receivers were made to sell for $250.00, by a famous builder of amateur radio sets. It is the finest construction with channel turret tuner and separate power supply, with heavy duty transformer. Has 8" heavy duty speaker. This is a complete manufactured television chassis, with all tubes, including the 15DP4 picture tube. When it is time for you to replace the picture tube, a 16" size will slip right in. Tube included are 3-6J6, RF amp., mixer and osc., 7-6AU6, 1st, 2nd, 3rd and 4th IF amp., 1st video amp., audio IF amp. and audio amp., 3-6BA5, video det., FM det., and sync. sep., 1-6AQ5 and tube amp., 1-12AU7, sync. separator, DC restorer and pulse inverter, 2-6SN7, horizontal osc. and amp., 1-6K6 audio output, 1-15DP4 kinescope, 1-6BH6 horizontal amp., 1-1B3 high voltage rectifier, 1-5U4 rectifier scanning and 1-5U4 low voltage rectifier. This chassis is all mounted on plywood for quick, modern installation. Picture tube is mounted in front and set is mounted on heavy plywood. Tube is mounted independently from television chassis, for more versatile installation. Chassis mounting template is furnished, as well as complete screw data. Set is completely wired and tested, picture tube installed. We know this is the best TV chassis value in the U.S. today. If you do not recognize the value of this set we will refund your purchase price. However, there are only 150 sets to sell, so don't delay ordering. Shipping weight 100 lbs. Stock No. 1520F. Minimum space required for mounting 24" wide, 20" high x 23" deep. Net price, complete with all tubes and the 15DP4 picture tube, ready to operate $169.95

A. Power transformer suitable for RCA 630 circuit 700 volts CT at 100 MA, 5 volts 3 amps., 5 volts 3 amps. and 6.3 volts 8 amps. Jefferson 1ugh. Shipping weight 12 lbs. Stock No. PS-4F. Net price $5.95

B. Deflection Yoke 201D1 for 12 or 10 inch picture tube. Net price $2.95 ea.

C. Focus Coil 202D1, 247 ohms DC resistance, for 10 or 12" picture tube. Net price ..... $1.95 each

D. Vertical deflection output transformer 210T2 for 10, 12 or 16" picture tube. Net price ..... $2.95 each

E. Vertical oscillator transformer 208D2, for 10, 12 or 16" picture tube. Net price ..... $1.50 each

F. Horizontal scanning coil 204T1, transformer. Stancor AT-5 for 10" picture tube. Has rect. element winding for 10 or 12" picture tube. Also has built-in flyback and scanning coil deflection yoke. Net price $1.49

SAVE ON T. V. PICTURE TUBES

McGee's special picture tube, supplied to us by a No. 1 TV picture tube builder, as slightly irregular. Full guarantee. We fail to note any difference between these and so called 1st. We guarantee total satisfaction.

10BP4	10 inch picture tube. Net	$17.95
12LP4	12 inch picture tube. Net	24.95
16LP4	16 inch picture tube. Net	39.95

100 RADIO TUBES $29.95

250,000 Tubes for fast sale. Tremendous value, and branded Hyvac Miniature Tubes for $29.95. replacement. 34c Each in smaller quantities.

Tubes up to $3.00 list. 100 Cartoned Over a million sold. Guaranteed full

1R5	12AT6	12SF5	6AQ5	9002	
1T4	35W4	12SG7	6AQ8	6BH6	
1U8	35Z5	12SH7	6AT6	12AU7	
3A4	50B5	6AT6	6K4	19T8	
3S4	12AT7	6AL5	6W4	6BJ6	
3V4	12AU7	6AQ5	6X4	6AT6	
3Q4	12AX7	6BF6	6AU6	6BA7	
3S4	12BA7	6AU7	12BH7	6AU6	
12BA6	12AU6	6SU7	9001	35C5	
12BE6					

$29.95 for 100

34c each

Popular G.T. Cartoned and Branded HYVAC

Guaranteed Full Replacement 39c ea.

1B4	6J5	6SD7	6SU7	12SF7
1V3	6Z7	6SF5	6V6	12SJ7
5Y4G	6K5	6SJ7	6X5	12SN7
6AC5	6K6	6SK7	12A8	25Z5
6BG6	6K7	6SL7	12BF7	32L7
6C5	6P5	6SN7	12K8	35Z5
6C6	6S7	6SR7	12SA7	50L6
6F6	6SA7	6SS7	12SA7	80

HYVAC 49c BRACKET

6BG6 6J6 6AX5

STANDARD BRAND Every Day Numbers 59c

12SA7GT 12SK7GT 35L6GT 50L6GT

6L6GA—$1.09 each, 10 for $10.00

Western Electric Type 25-B, a super heavy duty 6L6 lacks basing as best plugs in for 6L6. $1.95 each; 10 for $17.95.

STANDARD BRAND TUBES

CARTONED and UNCARTONED 49c

02A	35Z	6L7	7A5	12A6	12Z3	39	
1A4	5T4	6N7	7A6	12A8	14A7	43	
1A6	5V4	6R8	7A7	12AH7	14B6	45Z5	
1B4	5Y3	6S7	7B4	12AT6	14C7	50B5	
1B5	6A3	6SA7	7B5	12BA6	14H7	76	
1C6	6AB7	6SC7	7B6	12BD6	14Q7	77	
1C7	6AC7	6SD7	7B8	12BE6	14R7	78	
1D5	6AG7	6SF5	7C4	12C8	19	7SL7	
1D7	6B8	6SF7	7C5	12F5	25A6	75	
1D8	6C4	6SG7	7C6	12H6	25Z5	76	
1F4	6C5	6SH7	7C7	12J5	25Z6	77	
1F5	6C6	6SJ7	7E5	12K8	26	78	
1G4	6D6	6SK7	7E7	12Q7	27	80	
1G6	6D8	6SL7	7F7	12SC7	30	6BE5	
1H5	6E5	6SQ7	7H7	12SF5	32	6DT6	
1J6	6F7	6SR7	7L7	12SF7	33	61	
1L4	6H6	6SS7	7N7	12SG7	34	75B5	
1R5	6J5	6T7	7Q7	12SH7	35	304	
1S5	6J6	6V6	7R7	12SJ7	35A5	1616	
1T4	6K5	6X5	7S7	12SL7	35Y4	1217	
1V	6K6	6Y6	7V7	12SN7	35Z4	6AT6	
2A5	6K7	6Z7	7Y4	12SQ7	35Z5	6BA6	
2A6	6K8	6Z7S	7Z4	12SR7	36		
2A7	6L5	7A4	10Y				

G.E. RPX010 V.R. CART. $2.95

G.E. RPX010, with permanent needle $2.95

each; 10 for $24.95.

Kit of parts to build 6SC7 type preamplifier, $2.49 extra.

A lucky purchase by us enables this famous General Electric cartridge to sell

Webster N-7, same as 1-40, 1-70 ..... $1.19

Astatic M-1P-1, with needle 1.95

Astatic M1P-2, with needle 1.95

Astatic QT-3-M, with needle 2.95

Astatic L-12 or Webster Equal 1.79

Astatic L-12 or Webster Equal 1.79

Astatic L-70 or Webster Equal 1.79

Astatic L-70 or Webster Equal 1.79

Astatic needles, only, 10-for assortment.

Stock No. HA-22

REGULAR $25.00 TELEVISION MAGNIFIER

FOR 7-10-12 INCH TUBES

SALE PRICE $7.95

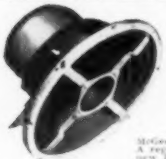
Stock No. HA-22 12x17 in. television magnifier. Made of crystal-clear plastic and oil-filled. Magnifies your present 7-, 10-, or 12-inch television picture so to fill your entire screen. We offer these new factory surplus magnifiers, you provide your own means of mounting in your set. Edge of magnifier may be milled and hung on your set with cord. This lens is a real buy and we know others likes to buy for less with cord. Net price, only $7.95. Shipped by express only. Ship. wt. 22 lbs.

McGEE RADIO COMPANY

PRICES F.O.B. K.C. Send 25% Deposit with order. Bal. Sent C.O.D. With parcel post orders include postage.

TELEPHONE VICTOR 9045. Write for Flyer
1422 GRAND AVE., KANSAS CITY, MISSOURI

McGEE OFFERS YOU THE BEST SPEAKER VALUES IN THE WORLD



MODEL CU-13X

12-INCH "COAXIAL"

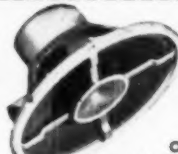
WIDE RANGE SPEAKER **$9.95**

★ NEW 1950 MODEL

★ Regular $32.50 List

On Sale at McGees for

McGee announces its new 1950 Model 12" coaxial PM speaker. A regular $32.50 list speaker, but mass production enables a new low price of $9.95. Made especially for McGee by a famous speaker manufacturer, to our own specifications. It's a new 1950 model. The sale of 10,000 coaxial speakers assures you that this speaker is a smart choice. The speaker consists of a 12" Alnico V PM with coaxially suspended 3" hard cone tweeter. [illegible] ... Net price $9.95, 2 for $19.00



MODEL P15-8

15-INCH "COAXIAL"

WIDE RANGE SPEAKER

★ NEW 1950 MODEL

★ Regular $62.50 List **$19.95**

On Sale at McGees for

"IT WOOFS AS IT TWEETS"

This 15", 35 watt peak coaxial PM speaker is not surplus. It is manufactured by a leading speaker company, to our own specifications. We buy them by the hundreds in order to offer them to you at this low $19.95 price. They are comparable to any $62.50 list speaker on the market. [illegible] ... Shipping Wt. 16 lbs. Stock No. P15-8. Sale price $19.95. Two for $38.00.

20—20,000 CPS. Wide Range Base and Treble Boost, Amp. Kit

$29.95

It's the newest thing in audio amplifiers. [illegible] ... $29.95. XX-34 WT wired and tested: $10.00 extra.

12-WATT AMP. KIT $9.95

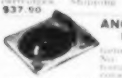
Kit Model TM-12. [illegible] ... YM-12 kit with tubes and diagram. $9.95.

VM-406 3-SPEED CHANGER

$33.21

[illegible] ... $37.90

ANOTHER RED HOT McGEE SCOOP



[illegible] ... $17.95

ALUMINUM VOICE COIL

REPLACEMENT SPEAKERS—FACTORY PRICES

McGee's Aluminum Voice Coil Double X Line. McGee offers you our Double X line of replacement P.M. Speakers. Made by a pioneer of the aluminum voice coil speakers. All of the Double X speakers have Alnico V magnets. All aluminum voice coils with RMA standard 3.2 ohm impedance. Why pay twice as much for a replacement speaker? McGee buys them by the carload and sells them for half price. Every speaker is unconditionally guaranteed.

Double X Aluminum Voice Coil, Alnico V Magnet, RMA 3.2 ohm V.C.

Stock No.				
4XX	4" square	1 Oz. Mag.	$1.09 ea.	10 for $10.00
5XX	5" round	1 Oz. Mag.	1.09 ea.	10 for 10.00
6XX	6" pincushion	1.47 Oz. Mag.	1.65 ea.	10 for 14.95
6XX2	6" pincushion	2.15 Oz. Mag.	1.95 ea.	10 for 17.95
46XX	4x6"	1 Oz. Mag.	1.49 ea.	10 for 13.95
57XX	5x7" oval	1.47 Oz. Mag.	1.95 ea.	10 for 17.95
7XX	7" pincushion (Auto set)	2.15 Oz. Mag.	2.79 ea.	10 for 24.95
8XX	8" pincushion	3.16 Oz. Mag.	2.55 ea.	10 for 27.95
69XX	6x9" oval	3.16 Oz. Mag.	2.55 ea.	10 for 27.95
12XX	12"	6.8 Oz. Mag.	4.95 ea.	5 for 22.50

Universal replacement output transformers for any push pull or single plate 2500 to 13,000 ohms from 2 to 16 ohm voice coil. Standard size strap mounting with long leads and lugs for voice coil connections.

U-5	5 watt universal output	$ .79 each	10 for $ 7.50
U-8	8 watt universal output	.99 each	10 for 9.50
U-15	15 watt universal output	1.19 each	10 for 11.00
U-20	20 watt universal output	1.49 each	10 for 13.95

HIGH FIDELITY OUTPUT TRANS. 20 20,000 CPS

Only $6.95

BEST VALUE IN U.S.A.

A-403—6600 ohms. Plate to Plate.

Why pay $20.00 or $30.00 for an output? [illegible] ... Net price $6.95

40 WATT OUTPUT "CAPEHART" HIGH FIDELITY $7.95

[illegible] ... $7.95 ... $5.95

RADIO SERVICE MEN

NOW YOU CAN WIRE A COMMERCIAL QUALITY AMP.

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[illegible] ... $9.95 ... $8.95 ... $12.95

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Attractive wood baffle with curved tri-color plastic front, for 8" speaker. [illegible] ... $1.95 ea. ... $17.50 ... $150.00.

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1422 GRAND AVE., KANSAS CITY, MISSOURI

Receiver Servicing Without A Signal Generator

By JAMES KAUKE

A calibrated superhet plus a volt-ohmmeter is all that is required to handle occasional receiver service jobs.

IN A rural or small-town locality, anyone whose neighbors know him to be a radio engineer is apt to be called upon for occasional receiver servicing. Where the volume of this work does not justify the expense of special instruments or a shelf full of service manuals, he can put his basic knowledge to work and get along with a volt-ohmmeter and a stable and accurately calibrated superheterodyne receiver which he may already own.

Many superheterodyne communications receivers make satisfactory substitutes for a signal generator, provided the operator knows the relationship of the local oscillator frequency to the tuning frequency for the receiver in question. To couple to the receiver local oscillator at high impedance, it is necessary only to thrust an insulated wire end into the appropriate coil can through the trimmer hole. The calibration of the receiver does not appear to be shifted by this, and the loosely-coupled signal is usually adequate for aligning the i.f. and r.f. tuning of receivers. A more elegant, though still inexpensive, way is to put into the communications receiver (author used a Navy RAX-1) a miniature tube connected as a cathode follower, loosely coupled to the receiver oscillator and feeding a concentric line connection. A 6C4 has about 400 ohms output impedance as a cathode follower, and the losses in a short line connected to it would not be serious; a 6J6 with both sides parallel (90 ohms) would actually match some lines.

Care should be taken that the heat from the additional tube does not affect any frequency-determining components of the receiver. If a true standard signal generator is desired, delivering known outputs at low impedance, a simple vacuum-tube voltmeter and a calibrated attenuator can be added at the end of the line. These parts, separable from the receiver, do not interfere with its normal use as a receiver.

The frequency range over which a signal can be obtained from the local oscillator of a superheterodyne receiver depends upon the receiver tuning range, the intermediate frequency, and whether the local oscillator operates above or below the incoming signal frequency. Table 1 shows the ranges of several receivers, band by band.

It will be seen that the RAX-1 (Unit

Table 1. Ranges of various superhets suitable for delivering signals to a receiver.

TYPE RECEIVER AND I.F. FREQ.	TUNING RANGE	LOCAL OSC. (L.O.) RANGE	REMARKS
RAX-1 Unit 1, 160 kc. i.f.	200-300 kc. 300-500 kc. 500-900 kc. 900-1500 kc.	360-460 kc. 460-660 kc. 660-1060 kc. 740-1340 kc.	L.O. above signal L.O. above signal L.O. above signal L.O. below signal
RAX-1 Unit 2, 915 kc. i.f.	1500-2400 kc. 2400-3800 kc. 3800-6000 kc. 6000-9000 kc.	2415-3315 kc. 3315-4715 kc. 4715-6915 kc. 5085-8085 kc.	L.O. above signal L.O. above signal L.O. above signal L.O. below signal
RAX-1 Unit 3, 2275 kc. i.f.	7-10 mc. 10-13 mc. 13-17.5 mc. 17.5-22.5 mc. 22.5-27 mc.	9.275-12.275 mc. 12.275-15.275 mc. 15.275-19.775 mc. 19.775-24.775 mc. 24.775-29.275 mc.	L.O. above signal on all bands in this unit.
BC-453-B 85 kc. i.f.	200-500 kc.	285-585 kc.	L.O. above signal
BC-946-B 239 kc. i.f.	500-1500 kc.	739-1739 kc.	L.O. above signal
BC-348-P 915 kc. i.f.	200-500 kc. 1.5-3.5 mc. 3.5-6 mc. 6-9.5 mc. 9.5-13.5 mc. 13.5-18 mc.	1115-1415 kc. 2415-4415 kc. 4415-6915 kc. 6915-10415 kc. 8585-12585 kc. 12585-17085 kc.	L.O. above signal L.O. above signal L.O. above signal L.O. above signal L.O. below signal L.O. below signal

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For FM, AM alignment and to provide TV marker frequencies. Highly stable Hartley oscillator has range of 150 kc. to 162 mc. with fundamentals to 54 mc. Colpitts audio oscillator supplies **pure 400 cycle sine wave** voltage for modulation. Use audio oscillator voltage to test distortion in audio equipment, bridge measurements, etc.

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Model 145-K. High gain—high frequency. Self-contained test speaker permits audible signal tracing of RF, IF, FM, audio and video circuits. Provision for visual tracing with VTVM. Response is well over 200 mc. 3-color harmonitome panel. 110-125 V. AC. Size: 10"x8"x4¼". Comes complete with tubes and diode probe in kit form.

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I. F. of "B"	252 kc.
Nominal dial reading of "B"	900-1100 kc. (seldom accurate)
Local oscillator of "B"	1252 kc. (picked up by "A")
Signal frequency required	1000 kc.
Tune "A" to	1160 kc. (if "A" is RAX-1)
Tune "A" to	761 kc. (if "A" is BC-946-B)

Table 2

Nominal dial reading of "B"	800-1100 kc.
Local oscillator of "B" picked up by "A" at	1082 kc.
"B" picks up local oscillator of "A" with RAX-1 tuned to	1150 kc.
Or BC-946-B tuned to	751 kc.
Actual signal frequency	990 kc.
Intermediate frequency of "B" is therefore	92 kc.

Table 3

1), or the BC-453-B plus the BC-946-B, would appear the best for delivering signals to align ordinary broadcast receivers. Doubtless there are numerous others which would be as good. The BC-344-D, BC-433G, ARB, DZ-1, or the DZ-2 would also be of use for the purpose.

An accurately-calibrated receiver was specified as a signal source. Actually, many operations require only a moderately close calibration. The calibration can be checked if necessary and a curve drawn by tuning in stations of known frequency. A list of these is available from the Superintendent of Documents, GPO, Washington, D. C. A calibration of the receiver is equivalent to a calibration of the local oscillator, provided the intermediate frequency is accurately known. If another receiver is available as a detector, the local oscillator can be calibrated directly by zero beating against stations of known frequency.

In aligning typical receivers, call the receiver being used as a signal source "A," and the receiver under test "B." In cases where the i.f. for "B" is available directly from the oscillator of "A," for example, where "B" has 456 kc. i.f. and "A" is the RAX-1 (Unit 1) or BC-453-B as shown in Table 1, the RAX-1 would be set to 296 kc. to deliver a 456 kc. signal; the BC-453-B would be set to 371 kc.

In cases where i.f. for "B" is *not* available directly from oscillator of "A," usually where "B" has a very low i.f., or where "A" does not tune below the broadcast band or has an i.f. above its lowest tuning range, a signal of the necessary frequency can be produced *in the mixer* of "B" as follows: Tune "B" to some convenient setting and pick up its local oscillator on "A." Note the frequency. Set receiver "A" to deliver from its local oscillator a signal which differs from the local oscillator frequency of "B" by the required intermediate frequency of "B," and feed to antenna input or mixer grid of "B." The intermediate frequency is then developed in the mixer of "B," if it is functioning properly, just as in normal reception. Table 2 shows the readings at various signal stages.

Without a service manual, the intermediate frequency of "B" may not be known unless it is stamped on the transformers. It may be determined by picking up the local oscillator of "B" with "A" and then ascertaining what setting of "A" gives a signal from the local oscillator of "A" which is picked up by "B." The tuning of "B" must not be changed during this test. Coupling should be loose. Naturally, if the i.f. trimmers of "B" are misadjusted very much, this measurement may be in error, but the trimmers may subsequently be reset to a different i.f. if the receiver can not be made to track (see Table 3).

The dial reading of "B," which in broadcast receivers is seldom accurate, plays no role in this measurement. Table 4 shows r.f. alignment and typical settings for the upper and lower ends of the broadcast band.

Since these signals are not modulated, it is desirable to connect a high-resistance d.c. voltmeter to the a.v.c. circuit of "B" as a tuning indicator. In the absence of this, one must tune by the carrier hiss. Overcoupled i.f. transformers can be adjusted symmetrically by detuning "A" 5 kc. each way and watching the voltmeter.

One of the first tests on a dead receiver having normal d.c. voltages should be an attempt to pick up its local oscillator on "A." Ordinary superheterodyne receivers can often be picked up at considerable distances.

—30—

Table 4

DESIRED SIGNAL	RECEIVER "A"	RECEIVER "A" SETTING
1340 kc.	RAX-1	1500 kc.
1500 kc.	BC-946-B	1261 kc.
550 kc.	RAX-1	390 kc.
550 kc.	BC-453-B	465 kc.

Analogous procedure would be followed for other bands.

Instant Heating Devices

(*Continued from page 65*)

Another feature of this child's phonograph is the operating switch in the playback arm rest. When the arm is in the rest a pin in the unit is forced against a leaf switch which is thus held open by the weight of the arm. When the arm is lifted off of the rest, the leaf switch closes the power circuit to the motor and the button current rectifier simultaneously, thus placing both in instant operation. By this means shut-off is assured since the child must put the arm back in the rest to stop the operation of the turntable.

Another tubeless device is the amplifier shown diagramatically in Fig. 3. A carbon button microphone and a loudspeaker combined with a source of button current will deliver an unbelievable amount of power when connected as shown in the diagram of Fig. 3.

Among the instant heating vacuum tube units is a record player which was housed in the same cabinet as the carbon pickup phonograph discussed previously. The circuit diagram of this record player is shown in Fig. 4. This instrument uses a 3A4 power output pentode and a selenium rectifier. The output of a high output crystal pickup (about 3 to 3.5 volts) will drive this tube sufficiently to give a sound output loud enough to satisfy a child. The tone quality of the unit is excellent. This device also uses the arm rest power control switch described before.

A two-tube version of this amplifier with negative feedback and other refinements is shown in Fig. 6. This device uses tubes requiring a lower filament current which means that the rectifier used in this connection can have a lower rating than the one required for the circuit of Fig. 4.

One very interesting device that has been built along instant heating lines is the automatic switchover preamplifier for the low output magnetic reluctance types and other phonograph cartridges. The photographs of Figs. 8 and 9 show one of these systems built into a *General Electric* FM tuner. By referring to the circuit diagram of Fig. 7 it can be seen that this preamplifier is straightforward with the exception of the two filament-type pentodes which are wired as triodes. A relay is wired into the filament string which is supplied from the selenium rectifier. It is, in part, the filament dropping resistance. In this set-up the isolation transformer primary is wired to the record changer's starting switch so that the instant the record player is turned on the amplifier will be in operation and the relay energized. The relay can then switch the amplifier input connection from the FM tuner output to the phonograph pickup preamplifier output. When the last record has been played and the record changer shuts off, the preamplifier ceases operation, de-energizing the relay and returning the FM output connection to the amplifier input.

Table 1. Filamentary tube types equivalent to heater-cathode types. The equivalence is based on the use of the tube type rather than on its specific characteristics.

TUBE	FILAMENT		HEATER-CATHODE	
	1.4 v.	2.0 v.	6.3 v.	12.6 v.
DIODE DETECTORS				
One Diode	1A3			
Two diodes			6H6, 6AL5	12H6
POWER AMPLIFIERS				
Triodes	Twin	Twin	Twin	Twin
High Mu	1G6GT	1J6G	6J6	12AX7
Medium Mu	3A5*	.....	6N7, 6N7G	12AU7
Beam Power	1Q5GT, 3Q5GT*, 1T5GT, 3LF4*	.....	6AQ5, 6V6, 6V6GT	High-volt. 6J types 20L7, 50L6, 50B5, 25L6, etc.
Power Pentode	3A4*, 1A5, 1C5, 1LA4, 1LB4, 1S4, 3S4*, 3Q4*, 3V4*	1F4, 1F5G, 1G5G, 1J5G	6AK6, 6G6G	High-volt. 6J types 43, 25A6, etc.
CONVERTER & MIXERS				
Pentagrid	1A7, 1LA6, 1LC6, 1R5	1C6, 1C7G, 1A6, 1D7G	6A7, 6SA7, 6BE6, 7Q7	12SA7, 12BE6, 14Q7
VOLTAGE AMPLIFIERS				
Triode	1LE3, 1G4G	1H4	6C4, 6C5, 6J5, 6L6, 7A4, 76	13J5, 14A4
Triode-Pentode-Diode	1D8GT, 3A8GT	.....	No equivalent	No equivalent
Triode-Double-Diode		1B5/25S, 1H6G	6R7, 7E6, 6SR7, 6SQ7	14E6, 12SR7, 12SQ7
Pentodes—				
Sharp Cut-off	1LC5, 1LN5, 1L4, 1U4, 1N5GT	1E5GP, 1B4	6AU6, 6J7, 6W7G, 7C7, 7L7, 7V7	12AW6, 12SJ7, 14C7, 12J7GT
Pentodes—				
Remote Cut-off	1P5G, 1T4	1D5GP, 1A4P	6BA6, 6D6, 6K7, 6SK7, 6S7, 6SS7, 7A7, 7B7	12BA6, 12SK7, 14A7, 12F7, 14H7
Pentode—				
One Diode	1S5, 1U5, 1LD5	.....	.....	.....
Pentode—				
Two Diodes		1F6, 1F7G	6B7, 6B8, 7E7, 7R7	12C8, 14R7

*Filament designed for 1.4 or 2.8 volts.

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2C21	.25
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2C34	.25
2C40	2.98
2C43	9.50
2C44	1.75
2C46	7.50
2C51	6.50
2D21	1.16
2E22	1.25
2E24	4.95
2E25A	4.25
2E26	3.95
2E30	2.39
2J21A	10.75
2J26	6.95
2J27	13.95
2J30	19.95
2J31	8.95
2J32	11.95
2J33	19.95
2J36	75.00
2J37	12.95
2J38	12.95
2J48	24.50
2J49	10.50
2JB51	4.95
2J54B	24.95
2J61	24.50
2K23	24.95
2K25	24.95
2K28	24.95
3AP1	4.75
3B22	2.50
3B23	4.95
3B24	1.98
3B24W	2.95
3B26	1.50
3B28	5.95
3BP1	2.50
3C23	2.25
3C24	.35
3C30	.30
3C31	3.50
3CP1	1.10
3DP1-A	3.95
3EP1	2.50
3E29	4.95
3FP7	1.75
3GP1	4.95
3JP7	7.95
4-65A	14.50
4-125A	27.50
4-250A	37.50
4A1	.98
4AP10	4.50
4C35	19.15
4E27	12.50
4J26	110.00
5AP1	1.85
5AP4	1.85
5BP1	1.75
5BP4	2.50
5C22	49.50
5CP1	1.50
5CP1A	9.95
5D21	29.95
5FP7	1.25
5GP1	3.50
5HP4	9.95
5J23	100.00
5J29	12.50
5JP2	9.50
5LP1	11.95
5MP1	4.95
5NP1	1.98
6AF6G	.88
6C21	24.95
6F4	5.95
6J4	4.95
7BP1	4.95
7BP7	4.50
7C23	75.00
7C24	80.00
7C25	90.00
7DP4	17.95
9C23	250.00
9GP7	15.00
9JP1	6.50
9LP7	15.00

Type	Price
9NP1	7.95
10Y	.39
10SPEC	.69
10BP4	22.75
10CP4	29.50
12DP7	12.50
12DP8	14.95
12FP7	14.95
12GP7	12.95
12HP7	12.95
12KP4	49.50
12LP4	49.50
15E	1.25
15R	.50
23D4	.49
24G	.35
35T	4.95
45SPEC	.35
53A	24.95
75TL	3.50
100TH	11.00
100TS	2.00
101F	4.95
114A	.69
114B	1.25
120	5.95
121A	2.65
203A	16.95
205B	4.50
205F	4.50
211	.40
215A	.40
218	12.50
221A	1.75
231D	1.50
249C	1.75
250R	7.50
250TH	19.50
252A	4.95
259A	4.95
262A/B	3.50
274B	2.00
275A	7.95
282A/B	9.95
283A	10.95
286A	10.95
290A	4.95
291A	4.95
294A	4.50
300A	3.95
301A	6.95
304B	5.95
304TH	3.50
304TL	1.30
307A	4.95
310A	7.95
315A	6.95
316A	.50
327A	2.50
328A	3.75
348A	5.95
350A/B	2.75
351C/D	19.95
357B	49.50
368AS	4.95
371A/B	.50
374A	2.50
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394A	3.50
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401A	1.95
403A/B	1.75
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434A	2.75
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810	7.75
811	2.00
812	3.50
812H	6.90
813	8.75
814	2.10
815	1.25
816	1.19
826	.35
829A/B	7.25
830	2.95
830B	3.25
832/A	4.95
833A	34.75
834	5.50
836	.90
837	1.50
838	2.25
841	.30
843	.25
845/W	1.00
849A/H	69.50
851	25.00
860	3.15
861	25.00
864	.35
865	1.95
866A	.99
866JR	1.19
872A	1.50
874	.35
876	.28
878	1.75
884	1.49
885	.98
889R	110.00
891	110.00
892	115.00
902P1	3.50
905	2.75
907	11.95
913	4.95
917	1.50
918	1.50
922	1.00
923	.75
925	1.40
930	.80
931A	2.60
934GT	1.50
949A	69.50
950	.98
954	.30
955	.35
956	.35
957	.19
958A	.18
959	.35
966A	.99
972A	2.95
975A	14.95
991	.23
1613	.15
1614	1.35
1616	.30
1619	.15
1620	4.95
1621	.98
1622	1.75
1624	1.05
1625	.35
1626	.25
1628	4.95
1629	.19
1631	1.15
1633	.35
1634	.79
1636	3.50
1638	.75
1641	.45
1642	.25
1644	1.49
1645	1.98
1649	1.25
1665	1.05
1851	.95
1852	1.06
1853	1.06
1960	.85
2050	.95
2051	.40
5514	4.95
5516	5.95
5562	10.00
7193	.18
8005	4.00
8011	2.00
8012A	1.25
8013A	1.25

Type	Price
8014A	24.95
8016	1.10
8020	1.25
8025A	7.95
8026	12.95
BR	2.50
BH	4.95
C1A	4.95
C1B	4.95
C5B	12.95
C6A	7.50
C6J	3.75
CEQ72	1.95
CK1005	.98
CK1006	.69
CK1009	2.75
EF50	.35
EL1C	4.95
EL3C	4.95
F123A	12.50
F128A	70.00
F660	110.00
FG17	2.75
FG27A	8.95
FG32	5.95
FG33	8.95
FG81A	3.75
FG95	9.95
FG105	9.50
FG172A	13.75
FG235	59.50
FG238B	160.00
GL146	9.75
GL473	[illegible]
GL502A	1.98
GL530	49.50
GL559	5.35
GL673	11.50
GL697	65.00
HF100	3.95
HF200	17.95
HF210	17.95
HF300	17.50
HK254	19.95
HV18	12.95
HY615	.20
HYE1148	.35
KU23	15.00
KU610	9.50
ML101	75.00
MX408U	.19
PJ23	1.55
R100	3.75
R200	7.95
R1130	12.95
REL36	.55
RK20A	7.50
RK22	4.95
RK23	4.75
RK31	2.50
RK33	.25
RK34	.25
RK39	1.75
RK51	3.95
RK52	4.50
RK59	1.75
RK60	.79
RK62	1.98
RK63	12.95
RK65	24.95
RK72	.65
RK73	.65
RX21	3.10
RX120	8.75
T20	1.50
T21	1.75
T55	3.95
T200	10.95
TZ20	1.50
TZ40	2.95
UH50	5.95
UX200	.75
V70D	6.95
VR75	.98
VR78	.25
VR90	.65
VR91	1.19
VR105	.75
VR150	.50
VT127A	3.00
VU111	.50
WL460	11.95
WL468	6.75
WL532A	1.75
WL562	150.00
WL616	85.00
Z225	1.95
ZB120	6.95
ZB3200	150.00
ZP477/12DP8	14.95

Type	Price
0A2	1.56
0A3/VR75	.98
0A4G	.94
0B2	1.74
0B3/VR90	.61
0C3/VR105	.78
0D3/VR150	.54
0Y4	.88
0Z4	.56
0Z4G	.58
01A	.24
1A3	.45
1A4	1.18
1A4P	.96
1A5GT	.48
1A6	.78
1A7GT	.66
1B3GT	1.49
1B4	1.18
1B5/25S	.88
1B[illegible]GT	1.06
1C5GT	.86
1C6	.98
1C7G	.98
1D5GP	.96
1D7G	.88
1D8GT	.94
1E5GT	1.38
1E7G	1.56
1F4	.74
1F5G	.74
1F6	1.56
1F7G	1.56
1G4GT	.68
1G6GT	.68
1H4G	.68
1H5GT	.53
1H6G	.86
1H6GT	.86
1J6GT	.88
1L4	.54
1LA4	.78
1LA6	.88
1LB4	.88
1LC5	.78
1LC6	.56
1LD5	.78
1LE3	.88
1LG5	.88
1LH4	.61
1LN5	.66
1N5GT	.58
1P5GT	.66
1Q5GT	.66
1R4	.68
1R5	.68
1S4	.78
1S5	.56
1T4	.56
1T5GT	.78
1U4	.58
1U5	.72
1V	.48
2A3	.96
2A4G	1.06
2A5	.68
2A6	.78
2A7	.88
2B7	.88
2V3G	.98
2X2A	.68
3A4	.36
3A5	.98
3A8GT	1.98
3B7	.34
3D6	.34
3LF4	1.28
3Q4	.58
3Q5GT	.66
3S4	.65
3V4	.80
5AZ4	.50
5R4GY	1.09
5T4	.98
5U4G	.56
5V4G	.88
5W4	.78
5W4GT	.66
5X4G	.58
5Y3GT	.36
5Y4G	.48
5Z3	.48
5Z4	.78
6A3	1.28
6A6	.88
6A7	.58
6A8	.78
6A8GT	.80
6AB5/6N5	.88
6AB7/1853	.78
6AC5GT	1.16

Type	Price
6AC7/1852	.78
6AD6	.88
6AD7G	1.28
6AF6G	.78
6AG5	.78
6AG7	.87
6AH6	1.28
6AJ5	.78
6AK5	.81
6AK6	.78
6AL5	.61
6AL7GT	1.06
6AQ5	.68
6AQ6	.58
6AQ7GT	.88
6AR5	.66
6AS7G	4.95
6AT6	.46
6AU6	.58
6AV6	.46
6B4G	.88
6B5	1.56
6B6G	.78
6B7	.88
6B8	.88
6B8G	1.28
6BA6	.54
6BE6	.56
6BG6G	1.16
6BH6	.56
6BJ6	.58
6C4	.24
6C5	.46
6C5GT	.46
6C6	.56
6C7	1.28
6C8G	.68
6D6	.46
6D8G	.87
6E5	.68
6E6	1.06
6F5	.46
6F5GT	.46
6F6	.61
6F6GT	.66
6F7	.81
6F8G	.86
6G6G	.68
6H6	.46
6H6GT	.46
6J5	.48
6J5GT	.48
6J6	.76
6J7	.61
6J7GT	.61
6J8G	1.28
6K5GT	.96
6K6GT	.41
6K7	.48
6K7GT	.48
6K8	.78
6K8GT	.78
6L5G	1.06
6L6	1.16
6L6G	.86
6L6GA	.86
6L7	.78
6L7G	1.16
6N6G	1.56
6N7	.78
6N7GT	.78
6P5GT	.96
6Q6G	1.06
6Q7	.58
6Q7GT	.58
6R7	.78
6R7GT	.78
6S7	.88
6S7G	.88
6S8GT	1.06
6SA7	.43
6SA7GT	.43
6SB7Y	.88
6SC7	.58
6SD7GT	.68
6SF5	.48
6SF5GT	.51
6SF7	.58
6SG7	.58
6SH7	.48
6SJ7	.56
6SJ7GT	.56
6SK7	.54
6SK7GT	.54
6SL7GT	.64
6SN7GT	.64
6SQ7	.43
6SQ7GT	.43
6SR7	.56
6SR7GT	.56
6SS7	.58

Type	Price
6ST7	.88
6SV7	.88
6T7G	.97
6U5/G5	.61
6U6GT	.72
6U7G	.54
6V6	.96
6V6GT	.62
6W7G	.88
6X4	.58
6X5GT	.48
6Y6G	.66
6Y7G	.88
6Z7G	1.14
6ZY5G	.68
7A4/XXL	.58
7A5	.72
7A6	.66
7A7	.56
7A8	.72
7AD7	1.06
7AF7	.72
7AG7	.71
7AH7	.88
7B4	.56
7B5	.72
7B6	.58
7B7	.58
7B8	.72
7C4/1203A	.56
7C5	.56
7C6	.72
7C7	.58
7E5/1201	.66
7E6	.58
7E7	.68
7F7	.68
7F8	1.06
7G7/1232	1.06
7H7	.62
7J7	1.06
7K7	1.06
7L7	.66
7N7	.66
7Q7	.58
7R7	.68
7S7	1.06
7V7	1.06
7W7	.88
7X7/XXFM	.88
7Y4	.56
7Z4	.56
10	.69
12A	.56
12A6	.18
12A6GT	.18
12A7	.97
12A8GT	.58
12AH7GT	.81
12AL5	.80
12AT6	.41
12AT7	1.16
12AU6	.66
12AU7	.78
12BA6	.56
12BE6	.48
12C8	.48
12F5GT	.57
12H6	.26
12J5GT	.76
12J7G	.80
12J7GT	.80
12K7GT	.53
12K8	.58
12K8GT	.66
12Q7GT	.48
12SA7	.56
12SA7GT	.56
12SC7	.56
12SF5	.56
12SF5GT	.56
12SF7	.56
12SF7GT	.56
12SG7	.56
12SH7	.51
12SJ7	.48
12SJ7GT	.48
12SK7	.56
12SK7GT	.56
12SL7GT	.58
12SN7GT	.51
12SQ7	.48
12SQ7GT	.48
12SR7	.48
12SR7GT	.48
12Z3	.78
12X3	.98
14A7/12B7	.68
14AF7/XXD	.88
14B6	.88

Type	Price
14B8	.88
14C5	.88
14C7	.88
14E6	.72
14E7	.88
14F7	.88
14F8	.88
14H7	.61
14J7	1.06
14N7	.88
14Q7	.56
14R7	.66
14S7	1.06
14W7	1.06
14X7	1.06
14Y4	.88
19	.97
19T8	1.56
22	1.28
24A	.66
25A6	1.06
25A7G	1.06
25AC5GT	1.16
25L6GT	.52
25Y5	1.16
25Z5	.48
25Z6GT	.48
26	.56
27	.46
28D7	.54
30	.56
31	.86
32	.96
32L7GT	.96
33	.68
34	.68
35/51	.56
35A5	.66
35B5	.61
35L6GT	.53
35W4	.38
35Y4	.48
35Z3	.56
35Z4GT	.43
35Z5GT	.38
36	.39
37	.34
38	.37
39/44	.26
41	.51
42	.48
43	.48
45	.51
45Z3	.56
45Z5GT	.48
46	.68
47	.68
49	.88
50	1.56
50A5	.68
50B5	.54
50L6GT	.54
50Y6GT	.56
53	.86
56	.43
57	.37
58	.48
59	.88
70L7GT	1.16
71A	.46
75	.52
76	.38
77	.42
78	.44
79	.88
80	.38
81	1.28
82	.86
83	.71
83V	.88
84/6Z4	.62
85	.68
89	.72
89Y	.38
117L7GT	1.28
117M7GT	1.56
117N7GT	1.36
117P7GT	1.26
117Z3	.56
117Z4GT	1.16
117Z6GT	.61
FM-1000	1.28
UX120	1.38
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9004	.36
9005	1.90
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In the photograph of the bottom view of the FM tuner with the preamplifier assembly (Fig. 8) the rectifier (Kotron strip) can be seen mounted on the front chassis wall. The isolation (power) transformer and the filter condenser block are mounted on the wall of the chassis near the drive flywheel. The top view (Fig. 9) shows the positioning of the components in the space originally occupied by the tuner's power supply which was subsequently removed. The amplifier, with a pair of 6A3's in the output and a *Thordarson* "Tru-Fidelity" output transformer, is shown at the left of the tuner.

Although the units mentioned in this article represent only a few of the uses for instant heating devices, many additional applications are feasible. The well-known and widely-marketed battery operated tuners and receivers are familiar to most readers and so were not considered in this discussion. More complex instruments and apparatus are, fundamentally, simply adaptations and extensions of the elements already described and most readers will quickly recognize the additional possibilities inherent in instant heating devices.

—30—

International Short-Wave

(Continued from page 56)

the G.O.C. Troops South Iraq, asking for the installation of yet another station at Beara. This not only catered to British troops but to Indian troops as well. Regular transmissions of Indian music and Indian announcements were given.

FBS radiated for some 14½ hours a day—starting at 6:30 a.m. and with only a short break—8:30-10:00 a.m.—continued to 11:00 p.m.

Servicemen took an active part in these programs. Quiz and magazine programs became extremely popular. The best received of all was *always* the request program—under the title, "Ask for Another."

It was decided in 1946 to move the headquarters of the organization from Egypt to Palestine where it remained until the evacuation of British troops from Palestine. Two m.w. transmitters were used—one in Jerusalem and the other in Haifa. A 7½ kw. s.w. transmitter covered the whole of the Middle East.

Mr. Knight comments: "It was during the time of the trouble in Palestine that it was found how invaluable a Service of this kind could be. Special orders from the G.O.C. to his troops were given over the network. Hourly announcements entitled *'Operation Beetle'* were broadcast in which items of interest and warning were given to the servicemen. When the decision was made known that the British were going to surrender the Palestine Mandate and conditions were unsatisfactory, the decision was made to move to Malta.

When Mickey and Felix were our leading "TV" stars...

Those celebrated "movie actors"—Mickey Mouse and Felix the Cat—were pioneer helpers in television research

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Photos from the historical collection of RCA

Felix the Cat and Mickey Mouse *were, during television's experimental period, the most frequently televised actors on the air. Using them as "stand-ins," RCA engineers gathered basic data on instruments and techniques.*

● Strange though it seems, two toys had much to do with television as you now enjoy it! As "stand-ins" during television's early days, Mickey Mouse and Felix the Cat helped RCA scientists and engineers gather priceless information.

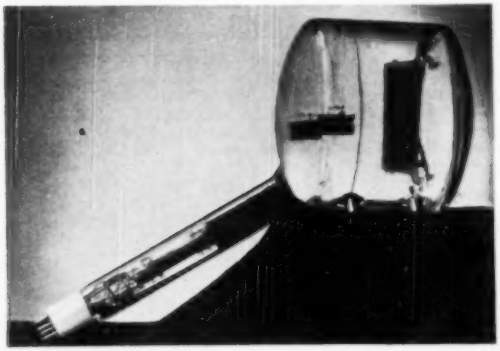
Choice of this pair was no accident. Their crisply modelled black-and-white bodies were an ideal target for primitive television cameras. The sharp contrast they provided was easy to observe on experimental kinescopes.

Would living actors have done as well? No, for what RCA scientists were studying—as they trained their cameras on the two toys—was the effect of changes and improvements in instruments and telecasting techniques. With living actors it could never have been absolutely certain that an improvement in the televised image came from an improvement in equipment and techniques—or from some unnoticed change in an actor's appearance, clothing, make-up. Mickey and Felix provided a "constant," an unchanging target which led to more exact information about television . . .

Problem after problem was met by RCA scientists, with the results you now enjoy daily. For example: In the "Twenties" and early "Thirties," there were still people who argued for *mechanical* methods of producing a television image, despite the obvious drawbacks of moving parts in cameras and receivers. Then Dr. V. K. Zworykin, now of RCA Laboratories, perfected the iconoscope, to give television cameras an all-electronic "eye"—without a single moving part to go wrong. Today, this same all-electronic principle is used in the RCA Image Orthicon camera, the supersensitive instrument which televises action in the dimmest light!

Also developed at about this time, again by Dr. Zworykin, was the *kinescope*. It is the face of this tube which is the "screen" of your home television receiver, and on its fluorescent coating an electron "gun"—shooting out thousands of impulses a second—creates sharp, clear pictures in motion. Those who may have seen NBC's first experimental telecasts will remember the coarseness of the image produced. Contrast that with the brilliant, "live" image produced by the 525-line "screen" on present RCA Victor television receivers!

Credit RCA scientists and engineers for the many basic developments and improvements which have made television an important part of your daily life. But don't forget Mickey Mouse and Felix. They helped, too!



The iconoscope, *electronic "eye" of television, invented by Dr. V. K. Zworykin, of RCA Laboratories.*

"The evacuation was a superhuman task. It involved the movement of approximately 1000 tons of valuable and irreplaceable technical equipment and more than 250,000 phonograph records. Stores and equipment had to be moved through openly hostile country against the will of two well-armed and determined partisan armies—each badly in need of such equipment for their own propaganda purposes; each willing to go to any lengths to persuade the British Army to abandon it, and each jealous and suspicious of the other's designs upon it.

"The main transmitter was located next to the headquarters of the Syrian Liberation Army—a well-organized and well-equipped band of about brigade strength—and the dismantling and evacuation of the whole unit had to be carried out under their very noses. At times, as the evacuation convoys moved slowly down along the deep valleys and gorges of the Palestine landscape, with heights on either side liable to be concealing the apparatus of a determined ambush, many a member of FBS wished he could remember more of the lessons on Bren guns and fieldcraft that he had learned in his earlier and more active days. FBS had its casualties—one man was killed, four others were badly injured. But somehow—by road, by rail, and by sea—everything went out and all that now remains as a reminder of FBS in Palestine are the two 400-foot aerial masts on Belt Jala, a hill overlooking Jerusalem itself.

"With the demobilization and natural rundown of the Service staff, the need for economy became more apparent. The installation in Malta will consist of medium-power shortwave stations. It is proposed to have transmissions beamed in an eastern and southern direction. The eastern beam is intended to take in Cyprus and Egypt and the southern beam to take in Tripolitania and Cyrenaica, and therefore the whole of the Eastern Mediterranean. In Commands and Districts where the number of troops justify it, relay stations will be installed. All stores and equipment have arrived in Malta and the FBS staff is most grateful to Army Movements for their assistance. Only a small number of phonograph records were broken and a few cases of equipment were lost."

The various persons who have been guiding the fortunes of the organization through the past eventful years have arrived in Malta. With Mr. Knight, who is Chief Broadcasting Officer and formerly of the BBC, came Captain J. C. Butler, K.O.Y.L.I., the Chief Administrative Officer, whose main problems deal with the organization of the FBS network; Maurice Taylor, again of the BBC, who is Chief Technical Officer and whose days are filled with the establishment of the technical equipment throughout the various stations; S. T. Moffett, Chief Programs Officer, who apart from handling the program side of the Network,

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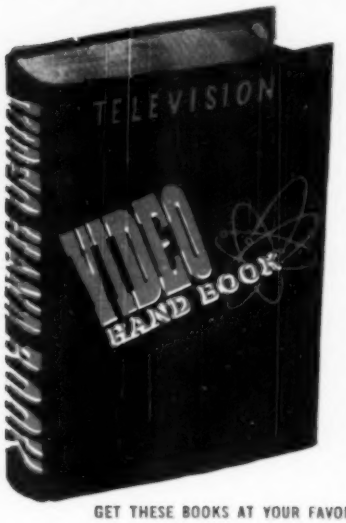

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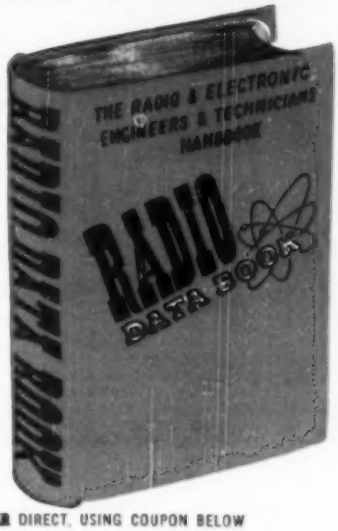

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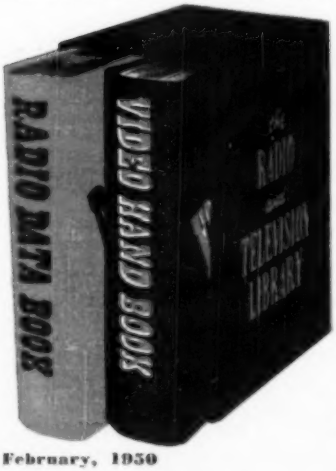

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is known to Middle East listeners through his sports commentaries and features from Palestine and Egypt.

Mr. Knight concludes: "With these senior members of the organization are the rank and file, some of whom have seen long and arduous service in many corners of the Middle East, and others—newer arrivals—who are being trained in the tortuous ways of radio. And so, with this slow but steady accumulation of material and personnel, it is hoped that before long, with the cooperation of Malta Forces, the headquarters of the Forces Broadcasting Service will once again be in regular operation while 'out-stations' in Kabrit, Cyprus, Tripoli, Benghazi, and East Africa continue to provide radio entertainment for the servicemen under the familiar callsign . . . "*This is your Forces Broadcasting Service . . .*"

* * *

Radio Indonesia

At the time this was compiled, Paul Dilg, California, had just received confirmation from M. P. Breedveld, Head of the Technical Department, Stichting Radio Omroep in Overgangstijd, Hoofkantoor, Batavia-C, Koningsplein Zuid 17, Batavia, Java, N.E.I., that the 6.045 outlet of *Radio Indonesia* in Batavia is the new 100 kw. transmitter.

Mr. Breedveld said: "Your reception report of the 100 kw. transmitter YDF on 6.045 is the second report I have received since experimental transmissions on this frequency started. . . . It was quite interesting to learn that you had a very strong signal in California, as radiation is not especially beamed in the direction of the West Coast of U.S.A. The target-area of the transmissions of 0400-1000 is South East Asia, and an antenna of rather unusual form is used. The radiation pattern shows a main lobe in the direction of Sumatra and Malacca, several small lobes to Borneo and Philippines, and a second main lobe over Java, Celebes, and New Guinea. It may be the power of the latter that reached California.

"The preliminary program schedule reads: 0400-0600 Indonesian, parallel YDE, 11.770, the latter beamed to Celebes (and so to California); 0600-0700 *English*, parallel YDC, 15.150, the latter beamed to Australia; 0700-1000 Dutch. We soon will add French at 1000-1100; you heard the November 7 test of this program. . . .

"Within a few weeks, transmissions beamed to India, Middle East, and Europe will start on 11.795 at 1115-1530 in Arabic, *English*, French and Dutch, under the callsign YDF-3.

"The British Far Eastern Broadcasting Service at Singapore moved from 6.770 to 6.045 on October 30, just a day before YDF started its transmissions. I hope the heterodyne will soon end, as their regular frequency is 6.075; the interference is very bad here since the program times are nearly the same."

Mr. Breedveld indicated that it is probable that the new 100 kw. Batavia outlet later will be used to beam programs to the United States around 2200-0100.

George Nordh, regular contributor to the ISW Department, shown at his Listening Post in his home in Sweden.

He also informed Dilg that *Radio Indonesia* is in charge of all broadcasting stations in Indonesia now except the stations at Jogjakarta of *Radio Republic Indonesia* but that the two organizations were to be merged shortly.

At the time this was compiled, YDF, 6.045, was fairly good level on the West Coast, according to Dilg and Balbi; here in the East it had bad QRM from BFEBS, Singapore.

* * *

Radio Club Notes

Norway—The *Norwegian DX-Listeners League* was founded May 3, 1948, by J. K. Bjoernseth, who has been an ardent radio fan for 15 years. NDXLL now has 25 members; while this may not seem impressive, it must be remembered that DX-listening on s.w. is a comparatively new hobby in Norway, and the League is the first radio organization of its kind in that country. The club publication is called "Night and Day," issued monthly. Address for those who are interested in further information is Norwegian DX-Listeners League, c/o J. K. Bjoernseth, Sorgen-frigata 10A, Oslo, Norway (Norge). (Halvorsen, S.W. Editor, *Radio Teknikk*, Oslo, Norway)

* * *

This Month's Schedules

Anglo-Egyptian Sudan—Radio Omdurman, 9.747, noted in Georgia 1400-1430 with Arabic program. (Fargo)

Argentina—Widely reported is LRT, 11.840, Tecuman; all Spanish; gives slogan (in Spanish) of "LRT, Radio Independencia, a new Argentina wave to all America." (Mesquita e Sousa, Portugal) Relays news in Spanish from *Radio Belgrano* 1700, continues with own program to 2300. (ISWC, London)

Australia—Recent changes to *Radio Australia* schedules include—1500-1630, VLB2, 9.65, and VLC11, 15.22; 1500-1655, VLA4, 11.85; 1643-1815, VLB11, 15.16, and VLC11, 15.22 (this one beamed by long-path to the East Coast of North America); 1700-1815, VLG6, 15.23 (to Europe and British Isles); and 1710-1815, VLA10, 17.84 (to

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18V	14V 3.5	3.98
18V	14V 5	4.98
30V	28V 3.5	6.49
30V	28V 5	8.49
30V	28V 15	14.49
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12.6vct 1.25A Cad HiVolt	1.49
6.3vct 3A Cad Bushed Cad	1.29
6.3vct 4A 2nd 6.3A Cad HiVolt	1.69
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906 1/10 .6W	.36
311 .28V	.15
313 .28V	.15
327 .6.3V	.15
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Type	Each	2 for	10 for
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1N38	$1.15	2.25	10.49
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0.607	216	700	1917	5810	22500
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1.03	220.4	733	1919	6100	23000
1.3	225	740		6125	23150
1.79	230	750	1922	6140	23325
2.5	235	800	1924	6200	23400
3	240	805	1926	6300	23600
3.63	245	850	1960	6495	24000
3.95	245.4	854	1980	6500	24600
4	250	899	1981	6840	25000
4.35	260	900	2045	6990	25200
5	271	910	2080	7000	25400
5.025	275	917	2085	7320	25831
6.25	280	940	2141	7500	26000
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7	289	1000	2151	7717	26600
7.8	299	1030	2150	7900	27000
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8	310	1067	2180	7950	28000
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11.26	320	1110	2195	8094	28500
12	325	1150	2200	8250	29000
13.52	330	1155	2250	8500	29500
14.2	340	1162	2300	8700	29850
14.25	350	1175	2400	8775	30000
14.5	360	1200	2450	9000	31000
15	366.6	1225	2461	9100	31500
16	370	1250	2485	9445	32000
17	375	1286	2490	9500	33000
19	380	1300	2500	9710	35000
20	390	1322	2525	9800	37000
22	390	1350	2600	9900	38140
23	400	1355	2625	9902	38500
24					
25	410	1400	2635	10000	39000
26	414.3	1488	2700	10430	39500
28	416.8	1495	2750	10500	40000
30	425	1500	2850	10600	42000
31.5	426.9	1510	2862	10900	41000
37	427	1518	2870	10936	41500
48	440	1600	2900	11000	47000
49	450	1640	3000	11400	47500
50	454	1646	3100	11450	48000
51.76	460	1650	3163	11690	48660
55	470	1670	1259	12000	49000
56.7	475	1680	3250	12500	50000
60	478	1710	3313	12800	52000
61	480	1712	3384	13000	55000
68	487	1740	3500	13100	56000
74	500	1770	3509	13500	57065
75	518	1800	3700	13550	58111
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105	612	1898	4314	16000	68000
107.5	625	1899	4400	16500	69000
107	633	1900	4444	16800	72000
120	640	1901	4500	17000	73500
121.2	641	1902	4720	17500	74000
125	645	1903	4750	17977	80000
130	649	1904	4850	18000	82000
135	650	1905	4865	18100	84000
140	657	1906	4900	18180	85000
147.5	665	1907	5000	18500	85750
150	670	1908	5040	18600	86000
160	673	1909	5210	19000	90000
165	675	1910	5235	19500	91000
170	680	1911	5270	20000	92000
175	681	1912	5300	20441	95000
179					

Any Size Above, Each ... 25c; Ten for ... $1.98

100000	175000	2400000	3550000	5700000
110000	180000	245000	3750000	575000
115000	180850	250000	3800000	6000000
118867	185000	265000	4000000	6200000
120000	186600	268000	402000	650000
125000	190000	270000	4200000	6540000
130000	194000	275000	4250000	6600000
135000	200000	294000	4250000	6900000
140000	201000	300000	4500000	7000000
141000	205000	307500	4650000	7161100
145000	210000	311000	4700000	7500000
147000	215000	314000	4780000	7611000
150000	220000	315000	4800000	8000000
155000	225000	325000	5200000	813000
160000	229000	330000	5215000	8500000
165000	230000	335000	5400000	9000000
166750	235500	333500	5421000	9300000
167000	238000	350000	5500000	9500000
169200				

Any Size Above, Each ... 35c; Ten for ... $2.98

MEGOHMS				
1.	1.579	2.5	3.9	6.5	9.05
1.1	1.7	2.7	4	6.8	9.5
1.2	1.65	2.75	4.23	6.7	10
1.25	1.75	2.8	4.25	7	11.99
1.3	1.8	2.865	4.5	7.5	12
1.35	1.9	3	4.7	7.92	12.83
1.39	2	3.1	5	8	13
1.4	2.11	3.5	5.5	8	13.99
1.5	2.2	3.75	6	8.02	19
1.57	2.25	3.9	6.3	8.5	

Any Size Above, Each ... 70c; Ten for ... $5.98

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15-20Hy / 150ma vac Input Use	$2.95
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30HY 45ma 3	1.00
15HY 400ma or 20HY / 300ma / 12KV	$7.95
30HY / 125ma New UTC Crocked Hi-Fi	2 for $2.25
80HY / 125ma Cad	1.98
40H / 100ma	1.49
12HY 275ma	3.89

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3735Kc	4780Kc	5405Kc
3980Kc	5030Kc	

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South America). VLC11 is sending a much better signal to Eastern North America than did VLA4 on 11.85.

VLX, 4.897, Perth, heard irregularly; news 0600; VLX2 replaced by VLX. (Balbi, Calif.) Heard in West Virginia fairly well mornings to after 0800; BBC news relay 0800.

Austria — ISWC, London, says the "Blue Danube Network" at Salzburg, U. S. Zone, is now on 9.490 at 0000-1700 but that announces 9.533.

Azores—CS9MB, 11.090, Ponta Delgada, heard on winter schedule 1500-1600; all-Portuguese, news in that language 1530; many popular recordings.

Brazil—This country is now on Summer Time. It will be observed each year between December 1-April 30, during which period the time will be *one hour ahead* of normal time; the Eastern part of Brazil will be *three hours ahead* of EST, and the Western part (Manaus, Cuiaba) will be two *hours ahead* of EST. This measure resulted from a general shortage of electricity in the whole country. It is the first time since 1931 that "summer time" has been used in Brazil. Brazilian radio schedules are affected accordingly. (Levan, Brazil)

PRL-8, 11.72, Rio de Janeiro, heard in Australia 0430, good signal in music and news in Portuguese. (Sanderson) ZYC-9, 15.370, Rio de Janeiro, heard in Newfoundland 1600-2130. (Peddle)

British Guiana—Cox, Delaware, gives schedule for ZFY, 5.984, Georgetown, as 0545-0745, 0945-1145, 1445-2150.

Bulgaria — Radio Sofia, 7.671, now has news 1630; has bad QRM and is seldom entirely readable. (Alcock, Ky.)

Cameroons — FIA6, 9.145V, heard 1430-1530 daily in Newfoundland. (Peddle) Heard in Pennsylvania 1455-1519 sign-off. (Starry) I have heard this one lately too after 1500 but with severe QRM.

Canada — CHNX, 6.130, Halifax, Nova Scotia, is scheduled 0800-2315; QRA is P. O. Box 400, Halifax, Nova Scotia, Canada. (Cox, Delaware) VE9AI, 9.540, Edmonton, Alberta, nice signal in news 2400; at 0015 has detailed weather report for entire Northwestern end of North American Continent, then popular recordings. (Hankins, Pa.) Noted very weak in Oklahoma 0900-0920. (Pierce) CKFX, 6.080, Vancouver, British Columbia, heard a recent Sunday signing off 0305; had cowboy music 0245-0300, news 0300-0305; this is a privately-owned station, 100 watts; fair signal but had shrill noise. CBNX, 5.970, St. John's, Newfoundland, noted Sunday with news 1400-1405, then "Sunday Serenade." (Cox, Delaware)

Canary Islands — Tenerife, 7.518, heard in Alabama well 1700-1800; signs with Spanish National Anthem; all-Spanish with Latin-type music. (Hagen)

Cape Verde Islands—ISWC, London, reports CR4AA, Praia, on a new chan-

(*Continued on page* 139)

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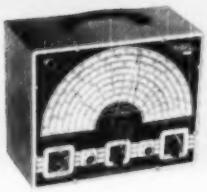

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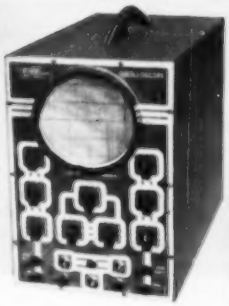

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SIGNAL GENERATOR

Model No. 320-K. An invaluable test unit for service, laboratory and school use. Highly stable Hartley oscillator has range of 150 kc to 102 mc with fundamentals to 34 mc. Ideal for quick alignment of FM-AM receivers; provides TV marker frequencies. Also supplies 400-cycle audio output from a Colpitts oscillator. Audio oscillator voltage can be used for testing distortion in audio equipment, bridge measurements, etc. Complete with tubes, portable case, etched panel, all parts, knobs, wire, shielded cable, instructions, diagrams, and operating manual. Size: 10 x 8 x 4¼". For 110-120 volts, 60 cycle AC. Shpg. wt., 10 lbs.

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VACUUM TUBE VOLTMETER

Model No. 221-K. An easy-to-build, sensitive VTVM for making measurements in high-resistance circuits. 15 different ranges, with DC input resistance of 26 megohms. 4½" meter is protected against burnout. Includes zero center for alignment of FM and TV discriminators. Double-triode balanced bridge circuit assures top stability. Ranges: AC-DC volts, 0-5-10-100-500-1000; resistance, 0-1000 ohms and 0-1-10-100-1000 megohms. With tubes, all parts, portable case, etched panel, wire, instructions, diagrams and operating manual. Size: 6 x 9½ x 5". For 110-120 volts, 60 cycle AC. Shpg. wt., 10 lbs.

83-152. *Only* **$23.95**

NEW 5-INCH OSCILLOSCOPE

Model No. 425-K. A sensational scope with *all* new features at amazing less price! With Push-Pull deflection! A precision instrument for TV, FM and AM alignment. Extra sensitive: .05 to .1 volts per inch. Wide range, flat from 5 cps to 500 kc, useful to 2½ mc. Wide range sweep circuit from 15 cps to 75,000 cps. Direct connection to plates of CR tube available at rear of cabinet. Complete with tubes (3-6SN7, 2-6J5, 5BP1, 2-5Y3 rect.), portable case, etched panel, all parts and knobs, wire, instructions, diagrams and operating manual. Size: 8¾" x 13¼" x 17" deep. For 110-120 volts, 60 cycle AC. Shpg. wt., 30 lbs.

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Model No. 511-K. A pocket-size reliable VOM. 3" meter. Germanium crystal for AC. Ranges: DC v., 0-5-50-250-500-2500; AC and output v., 0-10-100-500-1000; DC current, 0-1-10-100 ma. 0-1-10 amps; res., 0-500-100,000 ohms, 0-1 meg; decibels, —8 to +55. Complete kit, ready to assemble. Shpg. wt., 3½ lbs.

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SWEEP SIGNAL GENERATOR

Model No. 360-K. For visual alignment at TV and FM frequencies between 500 kc and 228 mc. For use with any scope. Sweep width variable from 0-30 mc. Crystal marker with variable amplitude. Provision for injection of external marker. Phasing control. Vernier dial calibrated in frequencies. Complete with tubes (2-6C4, 1-12AU7, 6X5GT rect.), all parts, shielded cable, portable case, panel, wire, instructions and operating manual. Less crystal. Size: 10 x 8 x 6¾". For 110-120 v., 60 cycle AC. Shpg. wt., 12 lbs.

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Audio Oscillator

(*Continued from page 61*)

trimmer may be used to narrow the range. If wider deviations are wanted, a larger capacity variable condenser may be used or the frequency of the two r.f. oscillators increased by removing the 100 $\mu\mu$fd. condensers from across the coils. However this last procedure tends to reduce the stability of the circuit.

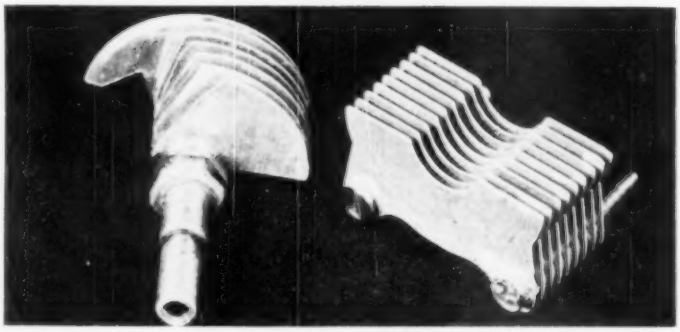
As shown in the scope photos, two traces are produced by the variable condenser, causing the sweep to vary from a low to a high frequency and back again. In judging frequency response from the scope, only one of the traces should be considered as the other is merely a reversed image. This has the occasional advantage, however, that while one of the traces will have an expanded low frequency end, the other trace will have an expanded portion at the high frequency end. The experimentally inclined constructor may find it practical to use a mechanical contact on the rotating shaft of the variable condenser to provide blanking during one of the traces. This, may be done by insulating half of the shaft with tape or other material and running a lead from a wiping contact to the oscillator output, thus shorting the output during one half revolution of the condenser. This will allow the scope sweep frequency to be doubled or the speed of rotation halved. A similar method would be to use the contact to provide a negative voltage to blank the scope trace, thus avoiding the appearance of a straight line through the center of the pattern. Marker pulses might be produced in a like manner, but it is usually simpler to draw them on a transparent screen covering the cathode-ray tube. The lowest frequency will be at one side of the screen and the highest at the other. The condenser may be rotated manually to any position and the frequency checked by Lissajous figures or other means and a mark made on the screen according to the degree of rotation. Zero degrees will be at one end, 45 degrees one-quarter of the way across, 90 degrees one-half way across, 135 degrees three-quarters and so on.

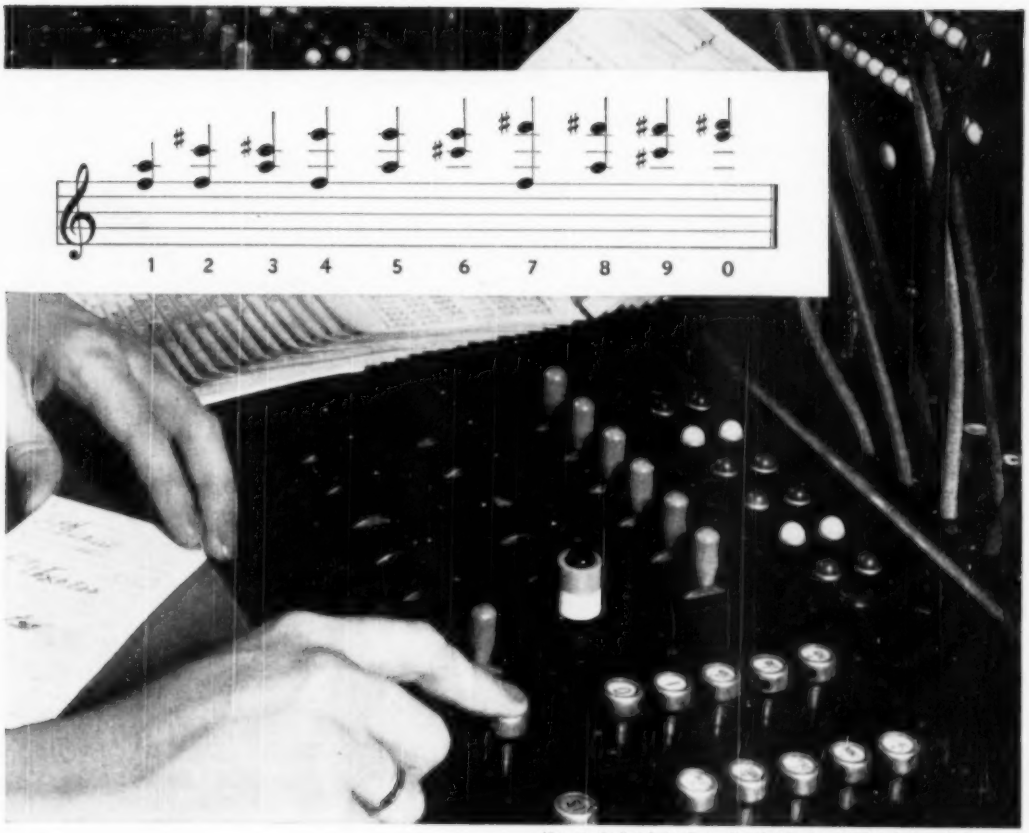
As suggested in the first part of the article, applications of a piece of test equipment of this nature are quite numerous. Besides presenting easily decipherable information regarding frequency response characteristics of audio equipment, the unit makes possible the observation of transient and harmonic distortions as noticeable in the oscilloscope patterns. Variations in which the width of the trace is unchanged but a displacement up or down occurs, indicate second harmonic distortion. Extra brilliance at the outside edges of the trace indicate flat topping and so on.

Response curves of amplifiers, tone controls, and resonant circuits, as well as a host of other pieces of equipment, are easily and rapidly traced, making this an ideal piece of equipment for an assembly line or a repair bench. If wished, a diode rectifier and filter may be used in conjunction with the unit to trace graphical response curves on the oscilloscope screen. In this case the output of the equipment under test is rectified and the resulting d.c. voltage applied directly to the vertical deflection plates of the oscilloscope. This makes a somewhat neater, though limited, form of presentation and the screen may be calibrated horizontally in frequency and vertically in decibels.

Tape or wire recorders may be easily checked with this instrument and a permanent recording kept for future use. In testing phonograph pickups it is, however, recommended that a commercial sweep frequency record such as produced by *Clarkstan* be used. Similarly, in testing disc recording heads it is important to have a playback pickup of known flat characteristics. In checking loudspeakers or microphones it is worth while to realize that room acoustics can appreciа-

View of the disassembled variable condenser showing detail of the specially cut taper. If more convenient, the stator may be cut in a similar manner instead. The condenser used was similar to the Bud "MC" midgets but any small condenser capable of 360 degree rotation might be used. Aluminum plates may be cut to shape with a fine-blade coping saw or rotated out of position one at a time and cut with shears. If care is taken in cutting it is not necessary to disassemble the condenser to cut the plates to shape.





Above is the Bell System's new "musical keyboard." Insert shows the digits of telephone numbers in musical notation, just as they are sent across country.

Playing a tune for a telephone number

Before you talk over some of the new Bell System long distance circuits, your operator presses keys like those shown above, one for each digit in the number of the telephone you are calling. Each key sends out a pair of tones, literally setting the number to music.

In the community you are calling, these tones activate the dial telephone system, to give you the number you want. It is as though the operator reached clear across the country and dialed the number for you.

This system, one of the newest developments of Bell Telephone Laboratories, is already in use on hundreds of long distance lines radiating from Chicago, Cleveland, New York, Oakland and Philadelphia, and between a number of other communities.

It will be extended steadily in other parts of the country – a growing example of the way Bell Telephone Laboratories are ever finding new ways to give you better, faster telephone service.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting, for continued improvements and economies in telephone service

bly affect the results, though not to as great a degree as in point-by-point checks, and a variety of tests in various positions is desirable. This, however, is not much of a problem due to the rapidity of the check.

Other possibilities include use as a form of panoramic wave analyzer through consecutive zero-beating of fundamental and harmonics of a continuous wave and as an audio frequency noise generator.

The unit described in this article is inexpensive and easy to build and has greatly increased usefulness compared to a conventional audio oscillator. An equalized output of approximately two volts is obtained from the unit shown and should be adequate for most applications. The flexibility of the system can be increased however by the addition of a power output stage. Push-pull is recommended to provide good low frequency response with minimum distortion. In any test run it is usually desirable to check the output of the sweep generator first to insure proper operation into the load used.

In conclusion, the constructor should find himself well repaid for the moderate cost in parts and time in adding this versatile unit to his test equipment.

—30—

SERVICING TIP

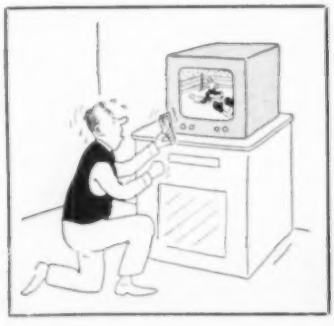
S. L. Chertok, sales promotion manager for Sprague Products Company, has forwarded a worthwhile servicing suggestion received from Richard Wiseman of Tomaso's Incorporated of Chicago.

One of the most pressing problems in servicing television receivers is a magnification of a frequent difficulty in servicing compact a.c.-d.c. "hot-box" table radios. How do you locate a defective condenser or other part which is defective only when it is heated up during actual operation?

Removing the receiver from its cabinet for test won't work since the extra ventilation does away with the damaging temperature rise.

Mr. Wiseman's solution is practical and ingenious. He simply uses a home type hair-dryer to blow a stream of very warm air on the suspected part. This simulates the "in cabinet" condition quite quickly.

—30—



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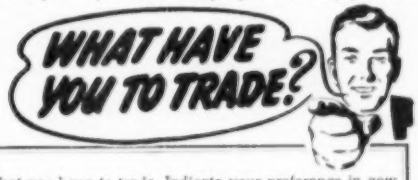

what you have to trade. Indicate your preference in new equipment. Back will come your big "Surprise" offer. So climb on the band wagon. Join with thousands who have discovered that there just isn't **anything** to equal a Walter Ashe "SURPRISE" Trade-In Allowance. Don't delay. Get your deal working today. Use handy coupon, write, wire, phone or come in.

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(show make and model No. new equipment desired)

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LETTERS *from our readers*

A GOOD IDEA

"HEREWITH submit an idea that may be worthy of publication. At any rate, I have had considerable success with it and would like to pass it on.

"Many amplifier builders have encountered ground loops in their amplifiers with their attendant headaches. It is difficult in an elaborate system to run many ground wires to one point in a low level stage. To overcome this, before mounting components, I insert a sheet of insulation paper in the bottom of the chassis, exactly the same size as the chassis. I then drill through it and mount all components. Now, instead of ground wires, I paint all my grounds on this sheet with regular silver paint used in printed circuits. When connections are to be made I cut out a tab, lift it up, paint with silver (very heavy), squeeze a lug on to it, and solder my wire.

"If the selected spot for a one point ground is not satisfactory, it is easily moved to another. I have been unable to create a ground loop with this method even when trying to do so as a test."

James G. Meyers
Audio Consultant
New York, N. Y.

* * *

FORGOTTEN MEN

"I JUST finished reading the editorial in your September issue. It congealed some ideas and thoughts I have had on the subject for some time. I feel compelled to write these thoughts with the hope that you will publish them in order to get adverse reactions from service technicians in places not now served by television.

"We grant that TV is growing by leaps and bounds. We grant that it will continue to grow. However, when you state that because the FCC is planning to add 42 new video channels to the u.h.f. band, which will mean over 1700 additional TV stations in remote areas, then I believe that you are taking too much for granted.

"I feel many will agree with me that the main problem in the extension of television to remote areas is economic, rather than technical. With the cost of a TV transmitter and associated equipment running from $200,000 up, plus the cost of coax cable extensions running into fancy figures per mile, just how, from an economic standpoint, could we expect thousands of small, isolated communities to ever have television service—unless, of course, there is a technical solution to the problem.

"Remember further that a TV station in a community not served by coax, that is, not on a network, will run out of program material worth looking at in something around two days. There just isn't the local talent for such a thing. Possibly Hollywood will become interested to the point of putting out films for such service only, but that also is questionable, as they would run into terrific objections from local theater owners. Remember also that the few local merchants who advertise would have to be liberal indeed in their advertising appropriations to support such a setup. There is also the question of just what volume of sales could be expected if purchasers knew that the only station they could receive would be the one local station. There would be no choice of programs, but just a 'take it or leave it' setup.

"There has already been a channel allocated to this city (Ironwood, Mich.) but so far I see no mad rush to start construction of a station, and for obvious reasons. Some way or another the investor must get his money back.

"In connection with your line of thinking, I would like to make another statement of fact. It seems to me, and to many other radio dealers with whom I have talked, that the manufacturers are going just a bit whacky on this television thing. In fact, they are going so cuckoo that they have all but forgotten that they have a dealer organization outside of the big television centers. This organization holds four major franchises. They are *Zenith*, *Philco*, *Admiral*, and *Capehart*. We have had console combination radios on order with all of them for nearly two months. The store is almost clean of console combinations, yet, to date, we have received just two 1950 combination consoles. Evidently these four companies, along with too many others, are devoting all their facilities to the manufacture of television receivers.

"We dealers in isolated communities (of which there are thousands) understand why they are doing it, but we wonder just what is going to happen to their dealer organizations which cost them so much to build up. What are we supposed to live on while they all get in the mad scramble in an attempt to capture the television market? Such a victory is bound to be short-lived at the best. Who pays our rent and what should we tell customers who want radio combinations?

"Can't you and these manufacturers see that there is still a market for harnesses and horseshoes, even in this age of the horseless carriage.

"Don't get me wrong. We are *for* television. It is a great thing. How-

"LITTLE DEVIL" RESISTORS

For quick, easy identification, resistance and wattage are clearly marked on every one of these tiny, rugged insulated composition resistors. In three sizes —½, 1, and 2-watt and all RMA resistances. Tolerance ± 5 and ± 10%.

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Available in 10 sizes from 25 to 1000 watts, Ohmite rheostats can be relied on for close control and long life. Ceramic and metal construction. Windings are locked in place by vitreous enamel, and the metal-graphite brush provides unsurpassed smoothness of action.

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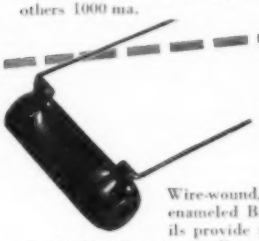
"Frequency-rated" for easy selection and top performance. Single-layer wound on low power factor steatite or molded plastic cores. Wire is held rigidly in place, insulated, and protected by a moisture-proof coating. Seven stock sizes from 3 to 520 mc. Two units rated 600 ma; all others 1000 ma.



"BROWN DEVIL" RESISTORS

Wire-wound, vitreous-enameled Brown Devils provide utmost dependability in a size small enough to fit most installations. Easily mounted by 1½" tinned wire leads. Three sizes: 5, 10, and 20 watts. Tolerance ±10%.

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It's quiet! This Type AB Potentiometer has a resistance unit that's solid-molded. As a result, the noise level often becomes less with use. Has a 2-watt rating, good safety factor.

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"LITTLE DEVIL" RESISTOR ASSORTMENT

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ever, careful thought tells us that we would like to use atomic energy to run our automobiles as well, but we just will have to wait, and, in the meantime we are hoping the filling stations don't close.

"All we dealers and service technicians ask is a reasonable chance to do a good job in our field without too many impediments and blows below the belt."

L. W. Van Slyck
Northern Electric Co.
Ironwood, Mich.

* * *

PHONE VS. C.W.

"ACCORDING to the National Bureau of Standards, a radiophone signal must be 14 db. stronger than a c.w. signal to maintain the same readability, thus db. $= 10 \log$ power ratio, $14 = 10 \log x$, $1.4 = \log x$, and therefore $x = 25.2$.

"From this it can be seen that if I am speaking to someone on c.w., running 40 watts, if I want to switch to phone and still maintain the same readability, I must increase the power to 1000 watts (100% modulation).

"It seems to me that this is reason enough for the respect given to c.w. by the Government and consequently for the code test.

"Phone is fine for communications under good conditions, but when things get bad, c.w. gets through as proven by the log equation. Another point is selectivity. I have an excellent communications receiver. On phone the best selectivity obtainable is 1 kc. More would destroy readability. On c.w., with a good audio filter, I can get 50 cycles. This means that for every phone signal, I could fit 20 c.w. signals.

"I operate phone often. For ragchewing I think it is better than c.w. But credit must be given where it is due."

David L. Wiesen, W2WHB
New York, N. Y.

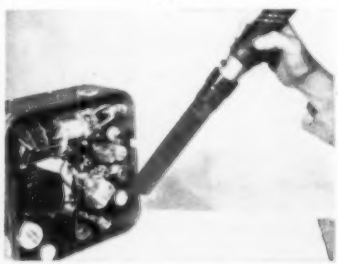
—30—

SPEED CHASSIS CLEANING

AN ordinary electric household sweeper with a suction attachment (see Fig. 1), will pull the bulk of dust and dirt from a radio chassis.

Car radios in particular pick up a lot of road dust which should be removed when they are serviced. H. L.

Fig. 1.



were exactly thirty-nine of them, and most were of the old-fashioned slow-heating type that take forever and a day to warm up. Boy! did he have some oldies in that mess! He got real annoyed because there were a couple I could not test. They seemed to have the filament leads brought out to pins on the sides."

"Old Kellogg tubes!" Mac exclaimed in the tone of fond reminiscence that a man usually reserves for speaking of an old flame. "He *must* have had some relics."

"By the time I waded through that basket, I decided there ought to be an easier way. That is when I started inventing."

"Well, they always say that if you want to find out the best and easiest way of doing something, just put a lazy man at the job," Mac gently jibed; "but what did you find out about that new customer's radio?"

"That's it playing there on the end of the bench. A 50L6 was out. She says that in the last two months she has put in three 35Z5's, and this makes the second 50L6. Yet most of the time the radio plays OK. Once in a while, though, she says it will kind of die away for a few seconds and then come back. She noticed, too, that when this happens the dial lamp flickers. Probably the 50L6 filament was intermittent for a while before it went clear dead. The set sounds perfectly all right now."

"Sounds logical except for one thing," Mac said with a frown. "That does not account for so many tubes going out in such a short time—especially the same kind of tubes."

He picked up a little rubber hammer such as doctors use to test muscular reflexes and struck each of the tubes sharply from several different angles. When he struck the 12SK7, the radio developed a sudden hum that slowly died away—along with the music. At the same time the dial lamp and the filaments of the 50L6 and the 35Z5 grew much brighter. A second sharp rap on top of the 12SK7 returned the dial lamp to normal brilliance, and a few seconds later music started coming again from the speaker.

"That 12SK7 cathode is shorting out to the heater," Mac said in answer to the mute question of Barney's arched eyebrows.

"That explains the hum," Barney agreed; "but what causes the filaments of the glass tubes to brighten up?"

Before answering, Mac sketched the diagram of Fig. 1 on the blackboard at the end of the bench.

"As you know, the tube filaments are all in series. Notice that the 12SK7 is in the middle of the string. In this set, the 12SK7 cathode goes directly to the chassis, as does one side of the line. When the filament of the 12SK7 shorts to the cathode, it is just the

same as though you placed a jumper from point 'X' to point 'Y.' Instead of the line current going through *all* of the filaments, it just goes through the 50L6 and the 35Z5. As the short first occurs, it causes a hum to be fed through to the speaker; but as the filament of the bypassed 12SQ7 cools down, both the hum and the music die away.

"Ordinarily, this short is brought about by the expansion of the hot 12SK7 cathode and filament. It is probably close to the 50L6 end of the filament; so this allows the remainder of the 12SK7 filament to cool down after the short has happened. The contraction that accompanies this cooling relieves the short. That is why she said the set would die away and then come back by itself."

"And I suppose the extra current that goes through the glass tubes when the short happens is what accounts for their short life. Get it? 'short happens' 'short life!' "

"Yes, I get it," Mac said, holding his nose, "and it ought to be buried. You had better go outside and air off a while after that pun."

"You'll be sorry you talked to me like that when I am wallowing in the government lettuce I will get for my invention," Barney warned.

"Yes, and *you* will be sorry if I catch you forgetting to check all the tubes carefully for shorts in an a.c.-d.c. receiver that seems to be exceptionally hard on filaments," Mac countered as he replaced the 12SK7 with a new tube from the bin.

—30—

CANADA'S MORALE-BUILDING BROADCAST STATIONS

By R. V. PARRETT, VE7TG

OF INTEREST to readers of RADIO & TELEVISION NEWS are the low-powered broadcasting stations maintained by personnel of the Canadian Army and the Royal Canadian Air Force throughout Canada's vast northland.

These stations are licensed by the Canadian Broadcasting Corporation for the entertainment of the service personnel who maintain the northern outposts and any civilians within range of the transmitters. Most stations are built and staffed by the post's personnel. They operate on powers ranging from 25 to 100 watts.

Programs are mostly recorded, with a sprinkling of Armed Forces transcriptions left over from the war days. Everyone going "outside" on leave or furlough is expected to bring back a couple of records.

Typical of the stations is CFSJ at the R.C.A.F. station at Fort St. John, B.C. The station is licensed for 50 watts and operates on 1600 kc. The "studio" is built into one corner of the airport control tower and is operated by the staff on duty in the tower. The transmitter which was originally housed in the tower had to be moved to a remote location to escape induction in the airport control circuits.

The station was promoted by Flying Officer Gillian and built by Leading Aircraftsman J. Crawford of the Air Force. Other station staff members contributed to the establishment of the station. The 50 watts is rather optimistic, they report.

The CFSJ "studio" located in the airport control tower at Fort St. John, B.C. At the mike of "The Tower Broadcasting System" is Flying Officer K. S. Bateman of the R.C.A.F.

Probably the most active station in the north is CFWH at Whitehorse, Yukon Territory. It is operated by the Canadian Army under Capt. C. J. A. Hamilton and technician Corp. Jack Spall of the Royal Canadian Signals. The whole military and civilian population of the busy northern town co-operate to keep the station on the air seven days a week.

A recent quiz show over CFWH netted $730 which was used to buy much-needed recordings and transcriptions for the station. The old AFRS transcriptions had been worn down to the felt on the turntables!

To provide the northern stations with program service the Canadian Army has located a 5000 watt short-wave transmitter at Edmonton, Alberta with the call VED. Programs are beamed to the Northwest Territories and picked up by CHAK, Aklavic; CFNW, Norman Wells; CFHR, Hay River; CFYT, Dawson City; and CFWH, Whitehorse. VED operates on 8265 kc. from 7 a.m. until midnight (MST) relaying the programs of CBX.

—30—

Radio station CFWH is a busy northern outlet maintained by the Canadian Army at Whitehorse, Y.T. Transmitter and studio are in an old army barracks on the Alaska Highway.

MONEY BACK GUARANTEE— We believe units offered for sale by mail order should be sold only on a "Money-Back-If-Not-Satisfied" basis. We carefully check on the design, calibration and value of all items advertised by us and unhesitatingly offer all merchandise subject to a return for credit or refund. You, the customer, are the sole judge as to value of the item or items you have purchased.

The New Model TV-20 A COMBINATION **20,000** OHMS PER VOLT **MULTI-METER and TELEVISION KILOVOLTMETER**

ADDED FEATURE
Includes an Ultra High Frequency Voltmeter Probe with a frequency range up to 1,000 MEGACYCLES. When plugged into the Model TV-20, the V. H. Probe converts the unit into a Negative Peak-Reading H. F. Voltmeter.

The Model TV-20 operates on self-contained batteries. Comes housed in beautiful hand-rubbed oak cabinet complete with portable cover. Built-In High Voltage Probe, H. F. Probe, Test Leads and all operating instructions.

9 D. C. VOLTAGE RANGES: At 20,000 ohms per Volt: 0-2.5 - 10 - 50 - 100 - 250 - 500 - 1,000 - 5,000-10,000 Volts

8 A. C. VOLTAGE RANGES: At 1,000 ohms per Volt: 0-2.5 - 10 - 50 - 100 - 250 - 500 - 1,000 - 5,000 Volts

8 D. C. CURRENT RANGES: 0-50 Microamperes - 0-5 - 50 - 500 - Milliamperes - 0-5 Amperes

4 RESISTANCE RANGES: 0-2,000-20,000 ohms - 0-2-20 Megohms

7 D. B. RANGES: All D. B. ranges based on 0Db = 1 Mw. into a 600 ohm line:
– 4 to + 10 db
+ 8 to + 22 db
+ 22 to + 36 db
+ 28 to + 42 db
+ 36 to + 50 db
+ 42 to + 56 db
+ 50 to + 64 db

7 OUTPUT VOLTAGE RANGES: 0 to 2.5 - 10 - 50 - 100 - 250 - 500 - 1,000 Volts

$39.95 NET

THE NEW MODEL TV-10

TUBE TESTER

The Model TV-10 operates on 105-130 Volt 60 cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

$39.50 NET

SPECIFICATIONS:

Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut Bottom, Hearing-aid, Thyratron, Miniatures, Sub-Miniatures, Novals, etc. Will also test Pilot Lights.

Tests by the well-established emission method for tube quality, directly read on the scale of the meter.

Tests for "shorts" and "leakage" up to 5 Megohms.

Uses the new self-cleaning Lever Action switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Has bayonet tapped filaments and tubes with filaments terminating in more than one pin are made to be tested with the Model TV-10 as any of the pins may be placed in the neutral position when required.

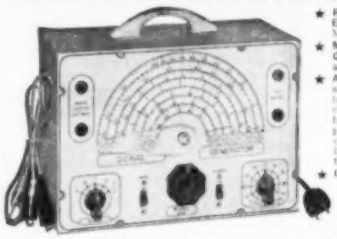
The Model TV-10 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

Free-moving built-in roll chart provides complete data for all tests.

Newly designed Line Voltage Control compensates for variations of any voltage between 105 Volts and 130 Volts.

The New Model 200 AM and FM

SIGNAL GENERATOR



★ **TUBES USED:** 12AU7—One section is used as oscillator and the second is modulated cathode follower. 7-Z is used as modulator. 6C4 is used as rectifier.

The Model 200 operates on 110 Volts A.C. Comes complete with output cable and operating instructions.

$18.85 NET

★ **R.F. FREQUENCY RANGES:** 100 Kilocycles to 150 Megacycles.

★ **MODULATING FREQUENCY:** 400 Cycles. Also available separately.

★ **ATTENUATION:** The constant impedance attenuator is isolated from the oscillating circuit by the buffer tube. Output impedance of this model is only 100 ohms. This low impedance reduces losses in the output cable.

★ **OSCILLATORY CIRCUIT:** Hartley oscillator with cathode follower buffer tube. Frequency stability is assured by modulating the buffer tube.

★ **ACCURACY:** Use of high-Q permeability tuned coils adjusted against 1/10 of 1% standards assures an accuracy of 1% on all ranges from 100 kilocycles to 30 Megacycles and an accuracy of 2% on the higher frequencies.

The New Model TV-30 **TELEVISION SIGNAL GENERATOR**

Enables alignment of television I. F. and FRONT ENDS without the use of an oscilloscope.

SPECIFICATIONS

Frequency Range: 4 Bands—No switching

1B— 32 Mc.
2— 82 Mc.
3— 98 Mc.
4B—250 Mc.

Audio Modulating frequency 400 cycles (Sine Wave). Attenuator 4 position, ladder type with calibrated impedance control for fine adjustment.

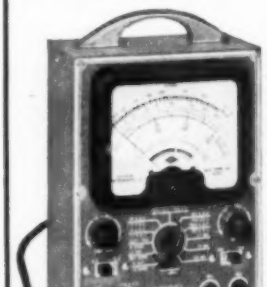
Model TV-30 comes complete with shielded co-axial lead and all operating instructions.

$29.95 NET

Tubes Used:
6C4 as Cathode follower and modulated buffer.
6C4 as R.F. Oscillator.
6SN7 as Audio Oscillator and power rectifier.

THE NEW MODEL 670

SUPER METER



A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS.

D.C. VOLTS: 0 to 7.5-15-75-150-750-1500-7500. **A.C. VOLTS:** 0 to 15-150-300-1500-3000 Volts. **OUTPUT VOLTS:** 0 to 15-30-150-300-1500-3000. **D.C. CURRENT:** 0 to 1.5-15-150 ma.; 0 to 1.5 Amps. **RESISTANCE:** 0 to 500-10,000 ohms, 0 to 10 Megohms. **CAPACITY:** .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics.) **REACTANCE:** 200 to 27,000 Ohms; 15,000 Ohms to 5 Megohms. **INDUCTANCE:** 1.75 to 70 Henries; 35 to 8,000 Henries. **DECIBELS:** -10 to +12, +10 to +38, +30 to +58.

The model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

$28.40 NET

An Accurate Pocket Size

THE NEW MODEL 770 **VOLT-OHM MILLIAMMETER**

(Sensitivity: 1000 ohms per volt)

Features:
Compact, measures 3⅛" x 5⅛" x 2¼". Uses latest design 2% accurate 1 Mil. D'Arsonval type meter. Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V-O-M in this price range. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long life even with constant use.

Specifications: 6 A.C. VOLTAGE RANGES: 0-15-150-300-1500-3000 volts.
6 D.C. VOLTAGE RANGES: 0-7½-15-75-150-750-1500 volts.
4 D.C. CURRENT RANGES: 0-1½-15-150 Ma.-1½ Amps.
2 RESISTANCE RANGES: 0-500 ohms, 0-1 Megohm.

The Model 770 comes complete with self-contained batteries, test leads and all operating instructions.

$13.90 NET

20% DEPOSIT REQUIRED ON ALL C. O. D. ORDERS

GENERAL ELECTRONIC DISTRIBUTING CO. DEPT. RN-2, 98 PARK PLACE, NEW YORK 7, N. Y.

Transcriptions

(Continued from page 34)

"stamper" so that it can resist the abrasive effect of the pressing material from which the final product is formed.

The "stamper" is punched and sheared to size, Fig. 12, and is finally checked by the Quality Control department as to dimensions, before being issued to the press department.

The information compiled by Quality

Filing "master" and "mother" for future use.

Control on these "stampers" is posted on three sigma control charts so that the production department can know daily whether or not the processing facilities are producing parts that fall within predetermined control limits for quality and tolerance.

The "master" and "mother," having produced the "stamper" plate, are routed to Production Control, where they are numerically filed by the code number originally assigned to the master recording upon receipt from the recording studio, Fig. 14. Here they re-

The transcription as it comes from the die of record stamping machine.

Visual inspection of each transcription.

main, the property of the customer, until his further need for production on this number.

The date of receipt of the "stamper" by Production Control is noted on its code card and the "stamper" is immediately sent to the press department with labels and a production order. The code card shows the production control clerk that production on this number was promised for immediate delivery. The press department receives the "stamper" plate and the job is routed to the first available press.

The "stamper," having been mounted in the record die, is ready to make the first impression, Figs. 13 and 15. This first pressing will be sent to Sound Check where it is played completely before an order to continue production can be given.

As production continues, the pressings arrive at the visual checking point and are checked for any flaws that would affect the play of the record or detract from its appearance, as in Fig. 16.

When the production of this order has arrived complete in the shipping department, the shipping clerk checks his shipping instructions and prepares the necessary shipping labels, waybills, etc. required to get these units of production to their required destination in the time originally specified by the customer.

The quality and engineering standard to which these electrical transcriptions must be produced for proper presentation over the air have been set by the National Association of Broadcasters. Their interest in keeping standards abreast of technological advancements has assured the listening public of high quality transcribed shows.

—30—

"Always picking up new pointers!"

AFCA NEWS

This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance, and operation of communications and electronic equipment for Army, Navy, and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join. Dues are $5.00 per year. Application should be submitted to the secretary at 1624 Eye St., N. W., Washington 6, D. C., who will furnish details upon request.

DIRECTORS' MEETING

The Board of Directors met in New York on December 7th. It was decided to appoint a special committee to re-examine the aims and purposes of the Association and the means to implement them. Col. J. D. O'Connell, President of the Fort Monmouth Chapter, presented a description of plans for the fourth annual meeting at Fort Monmouth May 13th. These plans include several spectacular "firsts" and promise to make the meeting the best so far held.

AFCA CHAPTER NOTES

Augusta-Camp Gordon

The sixth meeting of the chapter was held on November 16th at the Camp Gordon Officers' Club. Plans for a membership drive were approved and a nominating committee was appointed to handle business in connection with the annual election of officers at the next meeting.

At the close of the business meeting chapter members adjourned to the Unit Training Group Area of Camp Gordon where they inspected an Army Mobile Communications Center.

Chicago

The Chicago Chapter held its December meeting at the *Bell & Howell Company's* Lincolnwood plant on the evening of December 7th.

Chapter President Oliver Read presided at the meeting. Malcolm G. Townsley, *Bell & Howell* vice-president in charge of engineering, welcomed the group.

After dinner Charles E. Phillimore, vice-president in charge of manufacturing, briefly described production operations centering about the completely air conditioned 220,000 square

Bell & Howell staff discusses operation of microfilm equipment at the December meeting of the Armed Forces Communications Association in Chicago with Chapter President Oliver Read (right). Those taking part in the discussion are (left to right) S. E. Plattner, C. E. Phillimore, E. E. Strauss, P. M. Thomas, and M. G. Townsley.

SELENIUM RECTIFIERS
— and —
ELECTRONIC COMPONENTS

THREE PHASE FULL WAVE BRIDGE RECTIFIERS

Input 0-234VAC Type No.	Current	Output 0-250*VDC Price
3B13-1	1 AMP.	$ 22.00
3B13-2	2 AMP.	32.00
3B13-4	4 AMP.	56.00
3B13-6	6 AMP.	81.50
3B13-10	10 AMP.	105.00
3B13-15	15 AMP.	120.00

CENTER TAPPED RECTIFIERS SINGLE PHASE FULL WAVE

Input 10-0-10VAC Type No.	Current	Output 0-8*VDC Price
C1-10	10 AMP.	$6.95
C1-20	20 AMP.	10.95
C1-30	30 AMP.	14.95
C1-40	40 AMP.	17.95
C1-50	50 AMP.	20.95

RECTIFIER MOUNTING BRACKETS

For Types B1 through B6, and Type C1 ..... $0.35 per set
For Types B13 ..... 70 per set
For Types 3B ..... 1.05 per set

SINGLE PHASE FULL WAVE BRIDGE RECTIFIERS

Input 0-18VAC Type No.	Current	Output 0-12*VDC Price
B1-250	250 MA.	$0.98
B1-500	500 MA.	1.95
B1-1	1 AMP.	2.49
B1-1X5	1.5 AMP.	2.95
B1-3X5	3.5 AMP.	4.50
B1-5	5 AMP.	5.95
B1-10	10 AMP.	9.95
B1-20	20 AMP.	15.95
B1-30	30 AMP.	24.95
B1-40	40 AMP.	27.95
B1-50	50 AMP.	32.95

Input 0-36VAC Type No.	Current	Output 0-26*VDC Price
B2-150	150 MA.	$0.98
B2-250	250 MA.	1.25
B2-300	300 MA.	1.50
B2-2	2 AMP.	4.95
B2-3X5	3.5 AMP.	6.95
B2-5	5 AMP.	9.95
B2-10	10 AMP.	15.95
B2-20	20 AMP.	27.95
B2-30	30 AMP.	36.95
B2-40	40 AMP.	44.95

Input 0-115VAC Type No.	Current	Output 0-90*VDC Price
B6-250	250 MA.	$2.95
B6-600	600 MA.	5.95
B6-750	750 MA.	6.95
B6-1X5	1.5 AMP.	10.95
B6-3X5	3.5 AMP.	18.95
B6-5	5 AMP.	24.95
B6-10	10 AMP.	36.95
B6-15	15 AMP.	54.95

CUSTOM DC POWER SUPPLIES
Built to your specifications
We will be pleased to quote on your requirements. Kindly send for our specification form.

RECTIFIER CAPACITORS

CF-14	3000 MFD.	12VDC	$1.69
CF-15	6000 MFD.	12VDC	2.95
CF-1	1000 MFD.	15VDC	.98
CF-2	2000 MFD.	15VDC	1.69
CF-20	2500 MFD.	15VDC	1.95
CF-3	1000 MFD.	25VDC	1.25
CF-4	2X3500 MFD.	25VDC	5.45
CF-5	1500 MFD.	30VDC	2.49
CF-6	4000 MFD.	30VDC	5.25
CF-7	3000 MFD.	35VDC	5.25
CF-8	100 MFD.	50VDC	.98
CF-19	500 MFD.	50VDC	1.95
CF-16	2000 MFD.	50VDC	5.25
CF-21	1200 MFD.	90VDC	5.25
CF-9	200 MFD.	150VDC	1.69
CF-10	500 MFD.	200VDC	5.25
CF-12	125 MFD.	350VDC	2.49

Mounting clamps for above capacitors ..... 15c ea.

RECTIFIER TRANSFORMERS

All Primaries 105VAC 50/60 Cycles

Type No.	Volts	Amps.	Shpg. Wt.	Price
XF15-12	15	12	7 lbs.	$ 3.95
TXF36-2	36	2	6 lbs.	3.95
TXF36-5	36	5	8 lbs.	6.95
TXF36-10	36	10	12 lbs.	7.95
TXF36-15	36	15	20 lbs.	11.95
TXF36-20	36	20	30 lbs.	17.95
XFC18-14	18VCT	14	10 lbs.	5.95

All TXF Types are Tapped to Deliver 32, 34, 36 Volts. XFC Type is Tapped to Deliver 16, 17, 18 Volts Center Tapped.

RECTIFIER CHOKES

Type No.	Hy.	Amps.	Dc Res.	Price
HY5	.02	5	25	$3.25
HY5A	.028	5	20	5.95
HY10	.02	10	30	9.95
HY10A	.014	10	04	7.95
HY15	.015	15	30	15.95
HY20A	.007	20	.02	12.95

Type "A" low resistance chokes are specially suited to circuits requiring excellent voltage regulation.

ADDITIONAL SELENIUM RECTIFIER TYPES AND GENERAL INFORMATION MAY BE FOUND IN OUR CATALOG No. 719

VACUUM CAPACITORS
Standard Brands

12 Mmfd.	20 Kv	$4.98
50 Mmfd.	32 Kv	4.95
50 Mmfd.	32 Kv	5.95

Overall length 6½", diameter 2½", terminal diameter ¾". Shpg. wt. 2 lbs.

EDISON THERMO TIME DELAY RELAY

Heater voltage 115 V. Norm. open SPST contacts. 15-30 sec. delay. Contact rating 115 V. 3A., 440 V. 2A. Size 3⅝"x3¼" diam. Standard 4-prong tube base ..... Ea. 98c

OIL CONDENSERS

.5 Mfd. 400VDC. Telephone Type	$0.20
2X.1 Mfd. 600VDC Bathtub	.59
6 Mfd. 600VDC w /mtg. clamp	.79
8 Mfd. 660VAC/2000VDC w /brkts.	3.50
15-15 Mfd. 8000VDC Voltage Doubler Type 26F381 w /brkts.	5.95

KLIXON 40 SECOND DELAY SWITCH

Heater operates on 115 VAC or DC. Contacts DPST—one pair rated at 30 A. 115 V. or 20 A. 220 V. Auxiliary contacts for lighter loads.

Each $2.49

PILOT LIGHT ASSEMBLIES

Aircraft type, panel mounting, amber jewel only. Knurled rim controls "DIM-BRIGHT." Bakelite and aluminum construction. Bulb replaceable from front panel. For single contact bayonet bulbs, up to T-3¼ size. Dimensions: 2¼" overall length, ¾" diameter, ⅞" panel mtg hole. IMMEDIATE DELIVERY. 200 to carton, nested. $50.00 per carton. Prices on larger quantities on request.

G-R VARIAC

Type 100 R 2 KVA. Input: 110 or 220 V.A.C. 60 CPS. Output: 0-220 or 0-270 Volts. Brand new—limited quantity.
Shpg. Wt. 26 lbs. $39.50

ATTENTION!!!

Bulletin No. 713, listing various government and commercial surplus items, is now available upon request.

DC POWER SUPPLY

Limited quantity—
Gov't Surplus

Ready to operate. Full-wave bridge, copper-oxide rectifier, heavy-duty multi-tapped transformer. Input: 85/95/105/115 VAC 50/60 cps. Output: 2.5/24/28/32/36 VDC at 5 amperes, unfiltered.
For wall or bench mounting. Overall dimen. 9"x8¼"x8½" high. Shpg. wt. 30 lbs. Tested and guaranteed. $36.00
Filter Kit, 2% ripple $6.65

DIEHL MOTOR

Fan duty, brushless induction type (no TV interference). For 115 VAC 60 cycles, 46 watts, 1800 RPM, .88x3/8" diam. 1½" long. Noiseless ball-bearings—heavy cad construction. Brand new $4.50

RECTIFIER KIT No. 612-10

6 and 12 VDC at 10 Amps.

This unit will deliver unfiltered direct current for operation of motors, dynamotors, solenoids, electroplating, battery charging and similar equipment.
The two output voltages can be used simultaneously, and can be varied above and below their nominal ranges.
Complete with schematic diagram and instructions. Shpg. wt., 12 lbs. $15.95

FILTER KITS FOR No. 612-10

1 section choke input, 10% ripple $9.64
2 section choke input, 2% ripple 19.28

D-C PANEL METERS

Attractive, rugged, and reasonably priced. Moving vane solenoid type with accuracy within 5%.
0- 6 Amperes D-C
0-12 Amperes D-C
0-15 Volts D-C
Any range $2.49 each

Minimum order $3.00. No C.O.D.'s Add 10% for Prepaid Parcel Post and Handling. Terms: Net 10 days in the presence of approved credit.

All prices subject to change without notice.
Prices and delivery F.O.B. our NYC Warehouse.
All merchandise subject to prior sale.

WESTERN ELECTRIC BLOWER

#KS5881—Brand New—Heavy-duty Sirocco type blower, capacitor start, 1/40 H.P., 3400 RPM, 115 VAC, 60 cycles. Displaces 84 CFM. Extremely quiet operation. Opening 2½", overall size 7¼" long, 6" diam. Moisture and fungus resistant. With capacitor. Shpg. wt. 15 lbs. Quantity limited. $13.95

DIEHL BLOWER

Sirocco type, displaces 100 CFM, 115 VAC, 60 cps. Moisture and fungus resistant. Flange diameter 4". Overall size 7½"x6½". Removed from equipment. Tested and guaranteed $9.95

Adjustable right angle aluminum extension tube to fit flange 98c

WESTINGHOUSE AIRCRAFT MOTOR

Brand new—24 VDC or AC reversable on both. 1/50 H.P. 4800 RPM continuous duty. Length of leads 18". Dimensions 3⅛"x2¼", shaft ⅛" diam. by ¾" long. Gear Drive. Reversing switch with "off" position. Each $2.95

OPAD-GREEN COMPANY
71 Warren St.
New York 7, N. Y.
Phone: BEekman 3-7385-6

foot main building at the Lincolnwood plant.

Edward E. Strauss, project engineer, gave an illustrated talk on the *Bell & Howell* combat recording camera, followed by a demonstration by Stewart E. Plattner, microfilm products engineer, of automatic microfilm equipment.

A technicolor film of "Operations Crossroads," the Bikini tests, was shown with additional explanation by Lt. Col. Perry M. Thomas, *Bell & Howell* director of sales training, who was second in command of photographic activities for the Air Force observations at Bikini. The program concluded with an illustrated talk on atomic fission by Lt. Col. Thomas.

Decatur

Some 200 members and guests, including a considerable number from the University of Illinois, attended the November 17th meeting of the Decatur Chapter. The principal speaker was Col. A. M. Shearer, Chief, Procurement and Distribution Division, Office of the Chief Signal Officer.

Fort Monmouth

The chapter held its first fall dinner-meeting on November 16th. The two hundred members attending heard K. E. Gould of *Bell Laboratories*, New York, discuss the subject of coaxial cables as applied to communications and television.

A varied musical and legerdemain show directed and supervised by Lt. V. T. Hall of the Special Services School, aided by the Fort Monmouth Glee Club, rounded out a festive evening. Among those present were Maj. Gen. F. H. Lanahan, Commanding General of Fort Monmouth; Maj. Gen. J. O. Mauborgne and Brig. Gen. Harry Reichelderfer. Harry B. Haines, prominent newspaper publisher of Paterson, N. J., was special guest of the evening. Col. J. D. O'Connell, chapter president, acted as toastmaster at the dinner. Lt. Col. W. R. Herrlein, vice-president, and Col. W. L. Seibert, board director, were in charge of arrangements.

New York

The 1949 annual meeting of the New York Chapter took place on December 14th at the 71st Regiment Armory. Following dinner and business meeting, an extremely interesting demonstration of "Radar in Navigation" was presented by John E. Ganley, General Service Engineer of the *New York Telephone Company*.

San Francisco

Henry E. Austin, district manager of *RCA Communications, Inc.*, has been selected to head the chapter for the coming year. Plans are now under way for increased chapter activities.

Southern California

New chapter officers were recently elected as follows: president—A. C. Hohmann, Deputy Chief of Police of Los Angeles; vice-presidents: Loyd

C. Sigmon of Station KMPC, Kenneth B. Lambert of *Metro-Goldwyn-Mayer Pictures*, and Col. S. W. Sheely; secretary-treasurer: R. F. Walz of *Walkirt Co.*, Culver City.

The November meeting was devoted to a discussion of the military weather services by Col. T. R. Gillenwaters who was active in the AAF Weather Service during the war. The subject of the December meeting was "Sonar and Telemetering" presented by an official of *Bendix Aviation*.

Chapter of the Year Contest

Figures on the annual chapter contest, which ends April 30th, show that Fort Monmouth, headed by Col. J. D. O'Connell, has forged into first place as a result of its very successful membership drive in November. The Chicago Chapter, with Oliver Read as its president, is running a close second because of its splendid meetings and other activities.

New York University

Current officers of the NYU student chapter are as follows: president—William A. Bocchino; vice-presidents—Gilbert Ben-Haroche and Robert D. Hawkins; secretary-treasurer—Robert E. Buckley.

University of Alabama

The University of Alabama joined the roll of AFCA student chapters in November. The chapter was organized through the efforts of Lt. Col. R. A. Dutton, Asst. PMS&T, who reported that there has been considerable interest in the Association since its ROTC award at the university last spring.

—30—

USING OLD TV BOOSTERS

By JOHN R. DONNELLY, W3LVH

THERE are a lot of old television boosters on the market that can be put to good use by hams who have TVI. Most of these boosters have tuned-grid, tuned-plate, and make very good r. f. amplifiers.

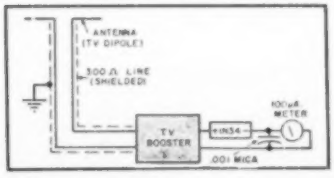
I am using an old Maryland booster that tunes from Channel 1 to 6. With a new 1N34 crystal and a meter I can locate my harmonics on Channels 2 through 6. This gadget also indicates any r. f. that may be present in a. c. lines.

This unit can be kept in operation at all times, to keep a check on harmonics that might develop.

A pair of phones can be used in place of the meter to monitor. I have my harmonic finder antenna located in the yard about 25 feet from the shack.

As the circuit Fig. 1 indicates, this is an easy way to whip one of the tougher problems in ham operation. —30—

Fig. 1. Diagram of booster conversion.



Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

MANAGEMENT LITERATURE

A check list of publications covering seven management fields has been issued by *American Management Association* of 330 West 42nd Street, New York, New York.

This complete bibliography includes a listing of the Association's publications during the past 18 years on such management subjects as personnel and industrial relations, insurance, marketing, office management, production, finance, and packaging.

Entitled "Progress in 7 Fields of Management," this bibliography is available on request from Association headquarters.

COMMUTATOR BOOKLET

Ideal Industries, Inc. of Sycamore, Illinois has prepared an elaborate 40-page booklet entitled "Commutator and Slip Ring Maintenance" which has been described as a handbook of procedures and methods.

The booklet is divided into four main sections dealing with "Trouble and How to Correct It," "Brushes," "General Maintenance Procedures," and a condensed listing and description of the company's maintenance products.

For details on how to secure a copy of this handy booklet write direct to the company at the above address.

TRIAD TRANSFORMERS

Triad Transformer Manufacturing Company of 2254 Sepulveda Blvd., Los Angeles 64, California has issued a new catalogue covering its line of geophysical transformers.

Known as "Geoformers," these transformers are completely described, illustrated, and priced in this new 4-page publication. In requesting copies ask for Catalogue CP-49.

WALDOM CATALOGUE

A catalogue listing replacement cone assemblies for both postwar and prewar models has just been issued by *Waldom Electronics, Inc.*, 911 North Larrabee Street, Chicago, Illinois.

It covers cone assemblies for every set from *Admiral* to *Zenith*. The information includes part number, set model number, o.d. of cone, and pertinent dimensions consisting of o.d. of speaker, i.d. of voice coil, depth of cone, type of spider, etc.

RECTANGULAR TV BULB

Details on *American Structural Products Company's* new rectangular television bulb are given clearly and simply in the new 4-page booklet just released for video tube and set manufacturers.

Rotated photographs and dimensional drawings are shown on the back cover of the bulletin, copies of which may be obtained from the Sales Promotion Dept., *American Structural Products Company*, Toledo 1, Ohio.

PRECISION CATALOGUE

A new catalogue covering the company's complete line of steel office, factory, and shop equipment has just been issued by *Precision Equipment Co.*, 3708 N. Milwaukee Ave., Chicago 41, Illinois.

Of particular interest to the radio service technician and radio manufacturer are parts cabinets, storage cabinets, shelf and shop boxes, and various other units for storing radio parts inventories or replacement components.

Copies of this 12-page catalogue are free of charge.

HERMETIC SEALS

A new 16-page catalogue on hermetic seals has been announced by *Hermetic Seal Products Company* of 37 South 6th Street, Newark 7, New Jersey.

The catalogue, covering both standard and custom designed hermetic seals, illustrates the company's exclusive multi-point plugs and multi-headers, high voltage terminals, and solutions to miniaturization, high altitude, and high ambient temperature problems.

Photographs are included for the different general kinds of seals, and engineering drawings give the details of specific alternative designs. Seals for various applications by manufacturers and users of relays, filters, transformers, condensers, etc., are also described and illustrated.

CROSSOVER NETWORK DATA

Racon Electric Company, Inc. of 52 East 19th Street, New York 3, New York has prepared a 4-page booklet which presents complete, practical instructions and a wiring diagram for the home-building of an economical, professional type of 1000 cycle crossover network.

A full range of specific inductance, capacitance, and resistance values is given, plus complete coil winding information, to adapt the crossover network for use with cone speaker impedances of from 4 to 16 ohms. The steps for the proper installation of crossover networks, wide range twee-

ters, and standard cone speakers are also described in detail.

Of particular interest to the sound technician and the music enthusiast, this booklet is free of charge on request.

"HI-FI MUSIC GUIDE"

Of interest to both laymen and sound technicians is the new book "High-Fidelity Music Guide" written by David Randolph and distributed by *Lafayette Radio* of 100 Sixth Avenue, New York City.

This concise, 12-page booklet is written in thoroughly understandable form and contains pertinent data on the selection of proper equipment to reproduce fine music with true fidelity.

In addition, the guide presents parts assemblies, cabinet location data, a glossary of technical terms, a chart of the range of musical sounds, and a technical explanation of the requirements for high fidelity sound reproduction.

EYELET CATALOGUE

The United Shoe Machinery Corporation of 140 Federal Street, Boston, Massachusetts is offering copies of its catalogue "Eyelets and Eyeleting Machines" to manufacturers and other processors.

This 18-page catalogue contains data on standardized eyelets, telescopic eyelets, canvas eyelets, grommets and washers, tag and calendar eyelets, fancy and special eyelets, and special metal products. In addition, the tools and machines for eyeleting are described in some detail.

Radio and electrical manufacturers are invited to secure their copies of this catalogue by writing to the company at the Boston address.

RESCO CATALOGUE

The 1950 *RESCO* catalogue, designed to assist service technicians, dealers, and sound technicians, broadcasters, and industrial firms select radio and electronic equipment, is currently being distributed by *Radio Electric Service Co.* of 7th and Arch Street, Philadelphia.

This 128-page catalogue has been carefully compiled in order to simplify purchasing problems and serve as a buying guide. Listings include thousands of items needed in radio, television, and electronics.

Copies are free for the asking and may be secured either from the company's Philadelphia store or from any of its eight branch outlets.

BROWNING EQUIPMENT

Browning Laboratories, Inc. of Winchester, Massachusetts has available a new 4-page flyer describing its line of radio and electronic equipment.

Included are photographs and descriptions of the company's frequency meters, oscillator grid dip meter, WWV standard frequency calibrator, a power supply and square wave

modulator, capacitance relay, signal system, oscillosynchroscope, oscillorecord camera, sweep calibrator, audio amplifier, frequency meter calibrator, two FM-AM tuners, and an FM tuner.

Prices and specifications are included in the bulletin.

"LANCASTER" BOOKLET

Radio Corporation of America's television distributors are currently circulating a new booklet designed to assist dealers in merchandising the company's new "Lancaster Series" of 16-inch television receivers.

This 16-page booklet, which is attractively presented in deep brown, russet and white, cites the advantages of the series' metal-coned 16-inch tubes and the principal features of the "Lancaster Series" instruments.

MODERNIZING DATA

Modernization data is now available for owners of the earlier types of the *Weston* Model 798 Tubecheckers, according to information received from *Weston Electrical Instrument Corporation*, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

All former types may be modified to include the latest tube calibration data. The conversion itself is not too difficult and can be easily made by the user with only simple tools. It is not necessary to return the checker to the factory.

The conversion is advisable for *Weston* Model 798 Types 3, 3A, 4, 4A, 5, 5A, 6 and 6A Tubecheckers.

SPRAGUE CALCULATOR

A new capacitor code indicator, just introduced by the *Sprague Products Company*, is designed to facilitate deciphering of molded paper tubular capacitor color codings.

The new capacitor indicator consists of a pocket-size plastic device with rotating dials printed in full and accurate colors. When flicked to the proper color bands, the dials instantly indicate capacitance, tolerance, and rated working voltage.

These handy new calculators are available either direct from *Sprague Products Company*, 51 Marshall Street, North Adams, Massachusetts or through the company's distributors. The units are $.15 each.

E-I CATALOGUE

Electrical Industries, Inc. of 44 Summer Avenue, Newark 4, New Jersey is offering a new folder which contains Bulletins 849, 850, and 851 covering sealed leads, multiple headers, and gasket type bushings.

Data and specifications are given on all of these units and in some instances detailed mechanical drawings accompany the descriptive material.

In requesting copies of this new folder ask for "Data & Specifications on *E-I* Multiple Headers and Sealed Leads."

—30—

What's New in Radio

(Continued from page 80)

ments. Each kit contains 11 universal parts. These are combined with a selection of shaft ends and base elements, which are sold separately, to provide maximum coverage of con-

centric dual replacement in home and auto radios as well as television sets.

The base elements, supplied in conjunction with the kits, are complete with no loose parts. The blue molded base has element, collector ring, and terminals installed. Complete step-by-step instructions are included with each kit.

OUTPUT ADAPTOR

A balanced output adaptor has been developed by the *General Electric Company*, Syracuse, N. Y., for use with its Model ST-4A sweep generator.

The sweep generator has a single-ended output, but with the addition of the new adaptor, balanced output is available. The adaptor, Type ST-8A, has been designed to give flat and balanced output when working into a 300 ohm resistive load.

The vernier output control of the sweep generator, normally incorporated in the output cable, is incorporated in the adaptor when using balanced output.

ORE DETECTOR

Tracerlab Inc. of 130 High Street, Boston 10, Massachusetts is now marketing a professional ore detector, designed for rugged field use in prospecting for all types of radioactive ores, such as uranium, thorium, radium, etc. It is said to be entirely unaffected by humidity or moisture and will even

operate after having been submerged in over ten feet of water, according to the company.

When radiation enters the small

Rensselaer Polytechnic Institute has announced that two members of the teaching staff at the Troy, New York institution have developed an entirely new, all-electronic color television system. Stations transmit color signals which can be picked up by present-type black and white sets and receivers designed to receive color. An adaptation of the device can be attached to motion picture cameras to permit color pictures to be taken with black and white film. In front of their equipment, used in research, are the scientists, Dr. Victor A. Babits (left) and Frank Hicks, Jr.

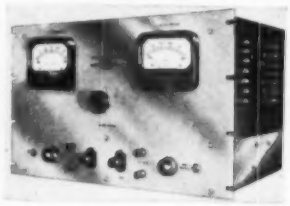
Geiger tube, which is contained in the probe, a clicking noise can be heard in the earphones, which are supplied with the instrument. A sharp rise in the number of clicks that are heard each minute above the normal "background," indicates the presence of radioactive substances. The tube has a low background rate of only about ten counts per minute at sea level.

The probe, which is mounted at the end of a flexible 30-inch cable, is sufficiently small to permit the exploration of crevices and small bore holes.

A copy of the booklet "Prospecting for Uranium" published by the U. S. Atomic Energy Commission and the U. S. Geological Survey is supplied with each Model SU-7 ore detector.

REGULATED D.C. SUPPLY

Designed for laboratory applications, the new Model EA-50A regulated d.c. power supply, introduced by *Chatham Electronics Corp.* of 475 Washington Street, Newark 2, New



Jersey, provides continuously variable output voltages from 0 to 500 volts.

Ripple is less than 10 millivolts. In addition, the unit provides 6.3 volts non-regulated a.c. output at 10 amps. and gives 1 per-cent regulation between 30 and 500 volts and 2 per-cent regulation between 10 and 30 volts.

The unit is available in either rack or cabinet mounting.

SILVER CELL BATTERY

Yardney Electric Corporation of 105 Chambers Street, New York 7, New York has developed and tested a new silver cell storage battery which is said to open new horizons to engineers working in the field of battery-powered electrical equipment.

The new "Silvercel" battery is only ⅛ to ⅕ the weight of common bat-

teries now in use. In bulk, the volume of the battery is only ½ to ⅓ that required of other batteries. The ampere-hour efficiency of the "Silvercel" is said to approach 100 per-cent and the energy efficiency is 85 per-cent.

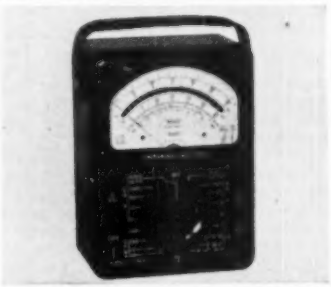
The unit is said to exhibit great re-

sistance to mechanical shock since there are no plates or separators to be damaged, and shock resistance is limited only by the strength of the case, which can be selected to meet any of a variety of requirements.

Now available are five types of "Silvercel" batteries ranging from 0.5 to 40 ampere-hour capacity. Several other large capacity batteries are now in the development stage.

NEW TRIPLETT V.O.M.

A new laboratory-type volt-ohm-milliammeter, the Model 630-A, has recently been added to the line of test



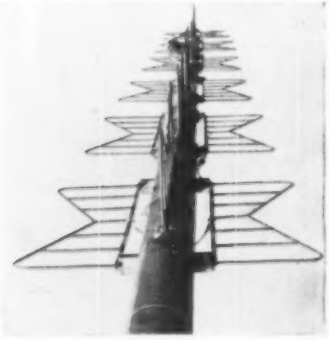
instruments manufactured by *The Triplett Electrical Instrument Co.* of Bluffton, Ohio.

Featuring mirrored, hand-drawn scales and greater accuracy made possible through the use of special ½% resistors, the new v.o.m. has six d.c. voltage ranges from 0 to 6000 at 20,000 ohms per volt, six a.c. voltage ranges from 0 to 6000 at 5000 ohms per volt, five d.c. current ranges, decibels, output, and resistance ranges from 0 to 100 megohms.

The instrument is housed in a molded base integral with the switch. It provides direct connections without cabling. One switch permits the selection of both circuit and range. There is a precalibrated rectifier unit.

—30—

Engineer makes final tests atop world's largest heavy-duty low-band television antenna installed by station KRLD-TV, Dallas. Built by General Electric at Syracuse, the antenna weighs 10,000 pounds and is 99 feet long. It is designed for 50-pound-per-square-foot wind loading, corresponding to a wind velocity of 150 miles per hour.



3-Tube Amplifier

(Continued from page 57)

section is a 20,000 ohm resistor and the variable reluctance pickup is connected across this. The upper section is a 1 megohm resistor and a crystal pickup would be connected across the entire input resistance, or across the two resistors in series. Both the voltage output and the input resistance requirements of a crystal pickup are much higher than those of the VR type. By using a voltage divider of this kind, the shunt resistance across the crystal pickup is kept high, yet the voltage at the first tube grid is reduced to a value comparable to the voltage output of the variable reluctance cartridge.

Unless precautions are taken to prevent it, the amplifier will pick up signals from strong nearby broadcast stations since it is quite sensitive. A 100 μμfd. mica condenser is connected from the first grid of the 12SL7GT to ground to bypass the r.f. and eliminate this effect.

The adjustable equalizer is in the plate circuit of the first section of the 12SL7GT. It appears in the photograph as the short shaft with the slotted end, between the two audio tubes and the rectifier. The equalizer consists of a 250,000 ohm potentiometer in series with a .01 μfd. paper condenser, shunted from the first plate of the 12SL7GT to ground. Moving the potentiometer arm toward the plate end of the resistance will increase the treble response and moving it toward the condenser end will increase the bass response. The equalizer may be adjusted for any desired degree of bass and treble response to suit personal preference. Once it is set to the preferred position it does not need to be changed thereafter. The equalizer adjustment affects the over-all gain of the amplifier. With the equalizer set for maximum treble response the gain will be very high and the response much too brilliant for the VR pickup. However, a crystal cartridge may be used with this setting. When the equalizer is adjusted for maximum bass response the amplifier gain is lowest, but there is still enough amplification to drive the 35L6GT to adequate room output. In practice, the equalizer is operated at a setting somewhere in the lower half of the resistance.

Although it does not show very well in the photograph, the 12SL7GT is shock-mounted by running the screws which fasten the tube socket to the chassis through small rubber grommets. By means of this simple expedient, the tube is made floating and so insensitive to shock and vibration that no trouble has been experienced from microphonics in this amplifier to date.

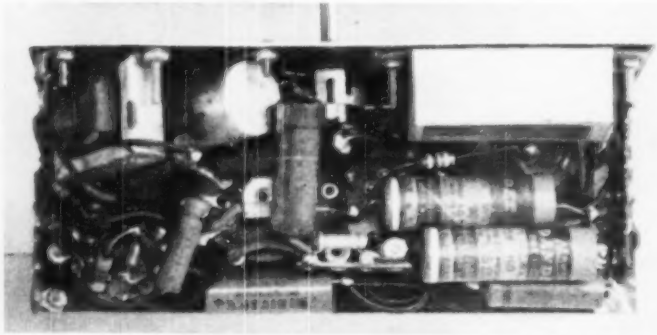
The amplifier gain is controlled by a 1 megohm potentiometer in the 35L6GT grid circuit. This is the long shaft extending from the side of the amplifier in the photograph. The a.c. line "on-off" switch is a part of this volume control.

The value of the condenser across the primary of the output transformer was determined by experiment and .02 μfd. was found to give the best audio quality. A .002 μfd. paper condenser is connected from grid number two of the 12SL7GT to ground to further smooth out the response of the amplifier unit.

Terminal strips of the "tie-point" variety are used for input and output connections.

The power supply filter circuit uses a small filter choke of the a.c.-d.c. type with 20 μfd. of filter capacity on either side. This is adequate filtering for a low hum level from the 35L6GT. Additional filtering for the 12SL7GT is provided by 20,000 ohm resistors and 20 μfd. electrolytic condensers. A 10 ohm resistor is used between the cathode of the rectifier and the filter to limit the peak charging current into the first filter condenser. A line cord resistor of about 220 ohms in value drops the a.c. line voltage for the tube heaters. A 220 ohm, 20 watt wirewound resistor could be used instead of the line cord resistor, or even the heater of another 35 volt tube could be connected in series with the heater string to accomplish the same purpose. The negative side of the

Under-chassis view of the three-tube amplifier. Parts placement is not critical.



To tell the TRUTH* you'll find the GREATEST BUYS at NIAGARA!

Famous UTAH
15 and 25 Watt Potentiometers

Body: 2-11/16" dia., 27/32" depth behind panel. Bushing: 7/16" dia., ¾" long. Shaft: ¼" dia., 7/16" long from bushing. Effective rotation 300 degrees. Mounts in 7/16" hole. 15 W. "PW" type wirewound on bakelite strip. 25 W. "SW" type wire-wound on asbestos-covered steel strip, for greater heat dissipation. PW type has 3 terminals, no off position. SW type has 2 terminals with off position.

15W Stock No.	Resistance In Ohms	25W Stock No.	Resistance In Ohms
PW-100	100	SW-1	1
PW-150	150	SW-2	2
PW-200	200	SW-3	3
PW-250	250	SW-5	5
PW-300	300	SW-10	10
PW-400	400	SW-15	15
PW-500	500	SW-20	20
PW-800	800	SW-30	30
PW-1M	1000	SW-40	40
PW-2M	2000	SW-50	50
PW-3M	3000	SW-60	60
PW-5M	5000	SW-75	75
PW-7500	7500	SW-100	100
PW-10M	10,000	SW-150	150
PW-20M	20,000	SW-200	200
PW-50M	50,000	SW-250	250
		SW-300	300
		SW-400	400
		SW-500	500

Stock No. PW-15 watt, ALL SIZES . . . **39c**
List $1.50. SPECIAL
Stock No. SW-25 watt, ALL SIZES . . . **49c**
List $1.75. SPECIAL

TERRIFIC PRICE SLASH!
BRAND NEW TUBES

TRANSMITTING		RECEIVING	
E1148	$ .34	1H5GT	$ .50
2C26	.28	3A4	.27
5BP1	1.70	3B7	.29
10Y	.28	3D6	.29
211	.28	6C4	.20
803	3.63	6AR5	.54
805	3.63	6D6	.42
811	6.80	6K7GT	.43
815	1.32	6SH7	.27
843	.18	6SS7	.53
954	.18	7C4	.28
955	.18	12A6	.45
957	.18	12H6	.22
958A	.18	12K7GT	.49
1619	.22	12SH7	.29
1625	.18	12SR7	.29
1626	.16	28D7	.29
7193	.47	35L6GT	.49
9004	.18	50B5	.49
9006	.18	5CL6GT	.48

All Quantities Limited

For additional Tube values see complete Niagara tube listing on page 69 this issue.

HEART OF THE BC-221 FREQ. METER

This VFO Sub-Assembly, used in BC-221 Freq. Meter, is ideally suited for home construction of:

1—Amateur V.F.O.
2—Freq. Mtr. Foundation
3—Portable Transmitter
4—Replacement for BC-221

Unit contains two temperature and moisture compensating coils, wafer switch, 3 variable condensers, silver mica, ceramic and silver mica condensers. FULLY WIRED and mounted on sturdy aluminum sub-chassis, ready for installation. Brand new in original packing.

N-276. Very special. **$6.95**

MORE BARGAINS
IN SURPLUS EQUIPMENT

1-2 or 3 of each
Check every line!

BC-348 Plug-in Tuning Units, New	$ 3.50
BC-221 Freq. Mtr. w/XTAL & Calib. Book—L.N.	75.00
LM Freq. Mtr. w/XTAL, Book, Mod., Exc.	90.00
TBY, Navy 6 & 10 Mtr. Bal. Transceiver	39.95
RME69 RCVR, w/54PKR—VY.GD.	69.00
BC-375 Tuning Units New—cased	4.95
BC-375 Tuning Units New—uncased	3.95
GE 25 Watt Phone XMTR Model GF1A Pow. Sup. Exc.	29.95
ATD 50 Watt XMTR New	49.95
JQ Navy 6V. Port. Audio Ampl. w/VIB. Sup. VY. GD.	9.95
Gibson Girl Emergency XMTR. New	2.89
BC-614 Speech Amplifier for BC-610 L.N.	55.00
W-1272 Electronic Wavemeter 22-30 Mcs. EXC.	44.95
BC-939 Ant. Tuner for BC-610 L.N.	59.90
Nat'l 1-10A RCVR, w/mtg. less Pow. Sup. L.N.	39.95
BC-342 Navy Comm. RCVR. Exc.	99.95
McMurdo Silver RCVR, Mod. 501 6-80 Mcs. w/tubes L.N.	29.95
Gen-Set 50-54 Mc. Conv. L.N.	24.95
Beach 80 Meter VFO New	19.95
Handy 28.5-29.7 Mc. Conv. New	27.95
BC-347 Interphone Amplif. L.N.	2.95
Dynamotor 5A 6068 Inp. 14V Out P. 450V.	4.95
GPT Tuning Units—New—cased	4.95
GPT Tuning Units—Used—cased	3.95
GPT Tuning Units—Used—no case	2.95
BC-221-H Model XTAL Test Osc. Exc.	14.95
Wilcox CW-2 10W Inspector Rifle New	75.00
Antenna Rotating Motor—RL-42A Rod Exc.	4.95
W.E. XMTR MOD Comp. w/controls spare—New	225.00
MN-26C Radio Compass—New	12.00
MN-26Y Radio Compass—New	26.95
75D Localizer Receiver Exc.	9.95
AN-APN-1 Altimeter—L.N.	18.95
APR-12 Receiver—Exc.	12.95
TG-10 Code Keyer—L.N.	14.95
274N Modulator BC-458A w/tubes Exc.	2.65
274N Modulator BC-458A Pair less tubes	4.64
SE-8522 Receiver BC-624 Exc. less tubes	7.95
SCR522 XMTR-BC-625 Exc. less tubes	14.95
BC-1000A Transceiver, New	300.00
BC-604 FM RCVR Exc.	14.95
BC-645 FM RCVR. Exc.	14.95
BC-645 Transceiver, Conts. Box, Dyn. Instruction book New	17.95
T-17 Handi-talkie 200 Ohm Imp. Exc.	69
T-24 Handi-talkie—7 Ft. Cord—Noise Filter—Plug—New	1.19
PE94 24V. DYN. for SCR522—Used—L.N.	2.95
Surplus Radio Conv. Manual Vol. 1 or 2	2.50
BC-610 Tank Units New	4.50
BC-654 80 Meter XMTR & RCVR. w/tubes & XTAL	34.95
Collins 32 RA-7 XMTR VT GD.	475.00
Teletype Code Machines (Less types) Exc.	18.95
ASD Radar Set Complete—New	(Price on Request)
ASD Parabolic Antenna—Reflector—L.N.	(Price on Request)
2501A Parabolic Ref. Ant.—L.N.	(Price on Request)
RT-84 APS-13A Electronic Camera	(Price on Request)
Sig. Gen. Ferris No. 19C	(Price on Request)

MEET THE WINNER!
of last month's TALL TALES CONTEST

J. C. JACKSON of Portland, Oregon copped this month's $5 prize with this tall tale—

"One winter in Northern Montana we installed a vertical antenna but because of very cold weather we ran a steam pipe up the center to keep ice from breaking the tower down. After several hours CQ in vain we discovered "standing waves" shivering around the tower trying to keep warm."

You may be next month's winner. Send your entry in today.

* Honest, this is no tall tale. Niagara's Prices just can't be beat!

NIAGARA'S GOLD-PLATED SPECIAL!

An ultra-high freq. Gold Plated Cavity Resonator with a range of 234-258 Mcs! Fully wired, including two 955 acorn tubes. Designed by the navy for use as a portable modulated test oscillator. CAN BE USED AS A MODULATED SIGNAL GENERATOR. Battery compartment is large enough to house speech equipment and power supply, making it a desirable portable UHF Transmitter for Ham use. Complete with tuning wrench, tubes, whip antenna, and circuit diagram on inside cover. Black wrinkle finished cabinet measures 9½"x 6½"x6¾".

The Buy of a Lifetime!
Cat. No. N-257. SPECIAL **$3.95**

WAVE TRAPS

Traps consist of two slug-tuned silver-plated coils and two ceramic condensers. All mounted on a cadmium plated bracket conveniently drilled and tapped for mounting. May be used to eliminate FM sound bars in TV sets, eliminate amateur interference (check regulations in TV Revs. Match Hi-Lo TV antennae, and dozens of other uses too numerous to mention. They're going fast, so order yours today.

Cat. No. N-128.
SPECIAL 3 for **$1.00**

DOES YOUR TV SET DROOP FROM INTERFERENCE BLOOP?

Banish Interference with New Niagara Hi-Pass Filter!

Positive protection against interference from amateur transmitters, ignition noises, diathermy and all other devices generating RF interference. Installed in 60 sec. 300 Ohm antenna feeder. Absolutely no loss in brightness or clarity. Easily assembled. Complete instructions. FCC filtering order actual test included.

Net $3.95. **$1.95**

Anywhere in U.S.A. plus 15c postage and handling.

ATTENTION AMATEURS!

Don't be blamed for TVI. FCC tests have proved it's not. Niagara's NEW LOW-PASS filter attenuates all frequencies above 30 Mc. faithfully. Expertly tuned M-Derived Filter for 10, 20, 40, 80 and 160 meters prevents TVI while you're operating. Eliminates all harmonics above 30MC at 60DB or better, passes all frequencies below 30MC. Complete, nothing else to buy. FCC report included.

No. N-279. **$4.99**

Plus 25c shipping charges in U.S.

BARGAINS IN NEW METERS

2" RD. Weston O-2 RF Ampl.	$3.49
2½" RD. Westinghouse O-5 A.C.V.	2.49
2" RD. Westinghouse O-3 RF Ampl.	4.95
2" RD. G.E. O-10 DC Ampl.	1.95
2" RD. Asst'd Brands O-1 KV DC	3.95
2" RD. Asst'd Brands O-1 R.F. Ampl.	1.98
4" RD. W. Electric 300-0-300 Yoo. Pot. Sen. 10-1 MA	7.95
3" RD. G.E. O-30 KVD. V.	2.95
2" RD. —6 to 108 DB. 10-1 MA Range (Illum.)	3.95

WRITE FOR NEW CATALOG "N"

IMPORTANT NOTICE: Please include 20% deposit with C.O.D. orders, unless rated. Orders received without postage will be shipped railway express collect. Send us your inquiries today. We correspond in English, Spanish, French, Italian, Polish, Rumanian, Hebrew, Portuguese, etc. Prices subject to change without notice. All stock subject to prior sale. All merchandise F.O.B. New York City. Minimum order $2.00.

Niagara Radio Supply Corp.
DEPT. N20 — 160 Greenwich Street, New York 6, N. Y.
Phone Digby 9-1132-3-4

power supply is not connected to the chassis, except through a .03 μfd. condenser.

The amplifier, a pickup arm and a dual-speed turntable and motor are mounted in a carrying case of the "suitcase" type. A five inch PM loudspeaker is used, which is somewhat small for best bass response. External speaker terminals are provided and when the amplifier is connected to a ten- or twelve-inch speaker, the bass response is improved and it will be found that the equalizer can be set farther toward the treble end. Despite the small speaker, however, the response on playback of this unit is excellent and the amplifier has proved itself to be just what was desired.

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Phono Pickup

(*Continued from page* 41)

on both sides of the beam. A differential or push-pull type of circuit has been devised in this coating. The terminals of the circuit are flat silver areas which make contact with similar areas in the cartridge.[1] A single screw in the cartridge may be loosened, and a new element, carrying a new stylus, may be easily put in place. (Fig. 2B)

This pickup is a linear amplitude type of strain sensitive transducer. It is a voltage modulator but not a voltage or current generator. Its total resistance is approximately 250,000 ohms, which does not change with audio frequency. This resistance is higher than that of earlier models. A polarizing voltage of about 45 volts d.c. is applied to the pickup element. This voltage is modulated by the resistance changes in the strain sensitive coating. The a.c. modulation voltage is taken off at the midpoint of the resistance. Although the bending strains on the sides of the pickup change the resistances, the total resistance does not change. The resistance changes in the two sides are equal and of opposite phase. One increases as the other decreases for each half of the stylus motion past its midpoint. Thus the voltages at the two ends of the resistance of the pickup remain the same, but the voltage at the mid- or single-takeoff point varies following the resistance changes in the coating.

A special preamplifier supplying the necessary polarizing voltage and having a unique tone control, incorporated in the preamplifier, provides wide and complete compensation for any type of record. It should be noted that all compensation is accomplished by means of degenerative feedback, not merely attenuating *RC* networks. (Fig. 3)

Two types of preamplifiers, both with or without an integral power supply, have been developed. One type

[1] For additional description of this pickup refer to "Phonograph Pickup Using Strain Gage," by Germeshausen and John, in *Electronic Industries*, November, 1946.

incorporates a one or a two stage gain circuit, made optional by means of a switch. The single 6SJ7 stage has a gain of 45 db. The second 6J5 stage makes a total gain of 70 db. possible.

The output voltage of the single stage preamplifier is .25 volt r.m.s. when using a *Clarkstan* 102 M sweep frequency L.P. record at 33 r.p.m. With the use of the *Clarkstan* 1000 A sweep frequency record at 78 r.p.m. the output is .32 volt r.m.s. When the two stages are used the voltage output values are 3.2 and 3.7. These records were used because of their convenience and the fact that their over-all level is about the same as that of many records just above the turnover point. The output voltages may be regulated by means of a volume control in the circuit. The tone control is not affected by the choice of one or two stages.

The other type of preamplifier offers a single 6SJ7 stage with a gain of 45 db., and output voltages, obtained as described above, of .22 and .21. By throwing a switch, the circuit adds a 6J5 cathode follower stage. The circuit with the cathode follower output has a gain of 42 db. with corresponding output voltages of .21 and .205. The tone control is completely flexible with either circuit. This second type of preamplifier, because of its lower output voltages, could be used only with a high gain amplifier.

The values of voltage and gain given are for the frequency characteristics described earlier in this article. The voltages are increased if a frequency pattern with more bass is used. In all cases the amount of extra low bass lift is controllable with the tone control knob. None of the preamplifier arrangements show any evidence of distortion when tested with a *Hewlett Packard* 200 BR oscillator and a *DuMont* type 208 B oscilloscope. This pickup and preamplifier combination is outstanding for its extended range, high fidelity and the natural quality of the music it helps to reproduce. The linear amplitude type of energy transformation in the pickup plus the level of its output allows complete tone control, with no introduction of distortion for any amount of tone correction. The combination of compensation by means of degenerative feedback, and the fact that the pickup is a modulator, not a generator of energy, appears to be a natural. No evidence of hangover effect, so common to crystal pickups and which contributes to blurring of the tones, is present. The music is as clean as the recording in the record. Microgroove and 45 r.p.m. records can be played with no fuzziness. All the quality that has been engineered into them shows up with crystal clarity and beauty.

The listening tests used in the development of this pickup were made using an *H. H. Scott* Type 210 A amplifier and an *Altec Lansing* Type 604 B speaker.

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MARS Station of the Month

MARS BEAMS WEEKLY BROADCASTS

MARS—Army Headquarters station, WAR, located at the Pentagon Building, Washington, D. C., broadcasts a weekly message each Tuesday at 0100Z and at 0400Z. (This is Monday at 8 p.m. and 11 p.m., Eastern Standard Time; Monday at 7 p.m. and 10 p.m., Central Standard Time; Monday at 6 p.m. and 9 p.m., Mountain Standard Time; and Monday at 5 p.m. and 8 p.m., Pacific Standard Time.)

Simultaneous broadcasts are made on frequencies 6997.5 kc., 14405 kc., and 20994 kc. Each message is sent three times, once at 10 words per minute, once at 15 words per minute, and once at 20 words per minute.

Designed especially to transmit quasi-official traffic and training information to MARS members, the broadcast offers an excellent opportunity to all amateurs in building up their code proficiency.

SCOTT Air Force Base Amateur Radio Club station K9FAE has been named the Air Force "MARS Station of the Month" for its all-around participation in amateur activities.

Lt. Maurice Rundquist, W9GPN, present custodian, is the nth of a long line of spiritual guardians of the ham shack and Corporal John A. "Pete" McKowen, W6FNE, is the chief op. The original call W9 Nice Sunny Days was issued early in 1946. The MARS call K9FAE was received 3 August 1949.

The scope of operation of K9FAE-AF9FAE just about covers the amateur radio spectrum, beginning with 75 meter phone and c.w. and ending up with 144 mc. phone.

MARS activities consist of meeting the Major Commands' net and acting as NCS for Headquarters Air Training Command nets. In addition to these schedules, which impose a fairly heavy demand on daytime operation, K9FAE is a regular participant in the Illinois Emergency Phone Net, the Illinois Traffic Net, the South Georgia Net, the Missouri Traffic Net and the Marine Corps Net which covers the Pacific and Far East on 10 meters.

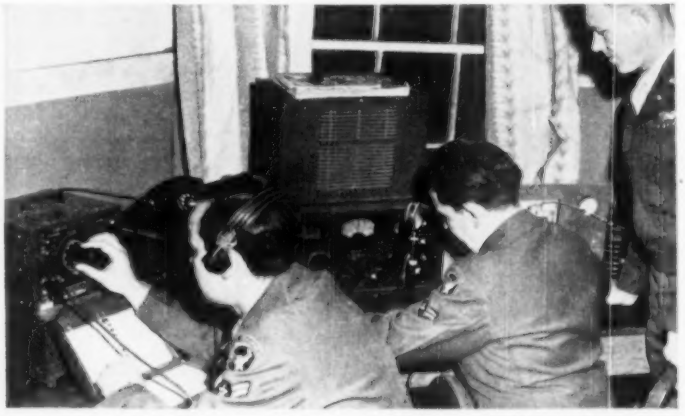
While K9FAE does not necessarily point for the Brass Pounders' League, the average traffic totals in the amateur bands totals 300 to 400 messages per month, which if added to the MARS traffic would make an impressive total.

The station's operation in the Amateur Emergency Corps proved a boon to the Military and civilians in the Belleville area last July when the Wood River tornado ripped down power and communications lines in that community. Using a PE 95 power unit and the regular gear in the shack K9FAE stayed on the air almost continuously for 48 hours handling local traffic on the 75-meter emergency phone net and relaying the long haul via 20 meter c.w.

For mobile emergency operation it is only necessary to call the motor pool for a 6 x 6 to nook on the power unit, lift the HT-9 and SX-28 from the shack and the gang is off for on the spot action. It also works out nicely for field day activities.

The shack is located in one corner

Corp. T. Reed, W9CQK, keeps a frequency check on the sigs at K9FAE while Corp. J. A. McKowen, W6FNE, holds a MARS schedule. Lt. M. Rundquist, W9GPN, custodian, looks on.



of a GI barracks and sticks to support a maze of sky wires are conveniently spotted around the building. The h.f. equipment comprises a BC-610E, for 10 meter and 75 meter operation, a BC 460 for 20 meters, and HT-9 for 40. Receivers are an SX-28 and a "Super-Pro." Antennas are doublets and end-fed Zepps cut for each band, plus a four-element, close-spaced beam on 10 meters.

The v.h.f. gear is the old familiar BC-639. BC-640 transmitter-receiver combination, rescued from salvage after the State control tower had had the best years of its life. To date only five states have been worked with the best DX being W5JTI but the hours of operation are considerable since K9FAE keeps a daily schedule with the St. Louis 2-meter gang. A 5-element, close-spaced array on top of a 66-foot stick helps the signal on its way.

The 6-meter rig is undergoing a complete overhaul from xtal oscillator to a pair of 24G's in the final. A 3-element, close-spaced beam on a 33-foot telephone pole using RG-8U to feed a folded dipole for the driven element has proven satisfactory. So far only three states have been worked on six with the best DX being W1HDQ, but the watchword is now "Sporadic E" with book being made as to who will be the first to snag an LU.

Lt. Lawrence Echelmeyer, W9SII, MARS Director for Headquarters Air Training Command along with 12 other MARS members and a host of SWL's at Scott AFB keep the filaments warm and the plates blushing pink at K9FAE just about 24 hours a day to set a smart pace for other MARS stations to follow.

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Within the Industry

(*Continued from page 24*)

ment Tube Department. He has been with the Radio Receiving Tube Division of the company for fifteen years. . . . **SAMUEL MORRISON** has taken over the presidency of *Morrison Steel Products, Inc.* while **JACOB MORRISON**, the former president, assumes the chairmanship of the board. . . . *The Magnavox Company* has appointed four new district sales managers, **BEN CLARK, RICHARD L. HOFFMAN, MARK L. CRUM,** and **GORDON WRIGHT**. . . . **SIDNEY A. JOFFEE** is the new vice-president in charge of merchandising for *Pathe Television Corporation*. . . . **LEWIS M. CLEMENT,** director of engineering and research for *Crosley Division*, has been named chairman of the executive committee of the Receiver Section of RMA's Engineering Department. . . . **WILLARD H. SAHLOFF** is the new manager of the *General Electric Company's* receiver division. . . . **S. M. WEINGAST** has been named president and general manager of *Precision Apparatus Company, Inc.* At the same time, **G. N. GOLDBERGER** was named vice-president and treasurer of the or-

ganization. . . . **R. W. FORDYCE** is the new general sales manager for the Television and Broadcast Receiver Division of the *Bendix Aviation Corporation*. . . . **RALSTON H. COFFIN** has been appointed director of advertising for the *RCA Victor Division* of *Radio Corporation of America*.

* * *

BURT G. SCOTT has been added to the sales staff of the Electrical Division of *Olin Industries, Inc.*

Mr. Scott, who is a sales engineer, will contact manufacturers of hearing aid and radio sets in the eastern states. He has been associated with the electrical field for several years, having held positions with the *MB Manufacturing Co.*, and *International Instruments, Inc.*, both of New Haven.

During the war he was attached to the Signal Corps, electronics section, as an instructor at Fort Monmouth, New Jersey.

* * *

TELEVISION BROADCASTERS ASSOCIATION, INC. has announced, through Raymond F. Guy, chairman of the Engineering Committee, that initial steps to effect standardization of TV equipment, as recommended by the TBA, have been taken by the Radio Manufacturers Association and the Institute of Radio Engineers.

Standardization of transmission levels will be undertaken by RMA, while the drafting of the methods of measurement of transmission levels will be handled by the IRE.

RMA will also start work on standardization of patch cords, plugs and jacks, camera cables and their associated connectors, and coaxial cable connectors. Work on picture geometry, started some time ago by RMA, will be continued by engineers of the manufacturers' group.

IRE will originate definitions and methods of measurement in the case of missing or obsolete standards upon notification by RMA, the IRE will formulate tentative proposals and forward them to RMA for comments and tentative approval, the RMA will make final suggestions and express approval, and finally the IRE will consider the RMA suggestions, reformulate and issue the standard definitions for test methods.

* * *

THE FIFTH ANNUAL TELEVISION INSTITUTE and Industry Trade Show held at the Hotel New Yorker in New York City is expected to draw an estimated 50,000 persons February 6th through 8th.

In addition to some 1000 industry registrants from all parts of the country, some 50,000 persons are expected to visit the two floors of television receiver and equipment displays which will be open to the public and television dealers.

Panel speakers will include industry

leaders, station managers, sponsors, agency executives, film and program producers, engineers, and educators. Also taking part in the panel discussions will be representatives of the FCC, the Armed Forces, manufacturers of television equipment, and audience survey groups.

The film industry is expected to be represented by approximately 500 persons including film directors, film producers and distributors, etc. These persons will be present for the Annual Television Film Conference which will be held in conjunction with the Television Institute on February 8th.

* * *

CHANNEL MASTER CORPORATION, as assignee of Joseph Y. Resnick, has received a favorable decision in its suit against *Video Television, Inc.* over ownership of U. S. Patent No. 2,465,331 covering a foldable television antenna.

Video Television, Inc. brought the action against *Channel Master Corporation* and Mr. Resnick, claiming that the invention had been made under circumstances which entitled *Video Television, Inc.* to the patent.

* * *

RADIO PRODUCTS SALES COMPANY of Los Angeles has signed a franchise with *Noblitt-Sparks Industries, Inc.* to handle the distribution of the *Arvin* line of radios, TV receivers, and appliances. . . . **RADIO DISTRIBUTING COMPANY** of Indianapolis will handle the *Arvin* line in Indianapolis and surrounding counties. . . . *John Meck Industries, Inc.* has appointed **JORDAN ELECTRONIC COMPANY** of Erie, Pa. as its franchise distributor in that area while **OHIO SPECIALTY COMPANY** of Cincinnati will handle sales in Cincinnati area. At the same time **ROBBINS DISTRIBUTING CORPORATION** was named franchise distributor for the New York City area. . . . **COLUMBIA DISTRIBUTING CORPORATION** of Seattle is the new distributor for *Admiral Corporation*'s line of home radio-phonographs and television receivers in the entire western Washington territory. **IRION COMPANY** of El Paso will handle the *Admiral* line in that area. . . . **SAMUEL N. STROUM** of Seattle has been named sales representative in the Northwestern States for *Insuline Corporation of America*. . . . *Amperex Electronic Corporation* has appointed the **ALLEN I. WILLIAMS COMPANY** of Denver as their sales representatives in Colorado, New Mexico, Wyoming, Nebraska, Utah, and Kansas. . . . *Pyramid Instrument Company* has appointed three new sales representatives, **DELAVAN ENGINEERING COMPANY** of Des Moines, **R. E. MYERS AND SON**, St. Louis, and **LESTER L. ELSTAD**, of Minneapolis. . . . *Technical Appliance Corporation* has appointed **THE BRANUM COMPANY** of Dallas to handle its line of TV, FM, and AM antenna systems and accessories. . . . **JAMES L. KEARNS** of Portland, Oregon has been appointed factory representative for the *Cinema Engineering Co.* of Burbank.

—30—

RADIO TUBES

At LOWEST Prices!

AM
FM
TV

Largest Tube Stock in the Country
ORDER TODAY for Immediate Delivery

29c ea.

1T4	6C4	47	28S	1A6	1F5G	
1U4	6F8GT	50	25Z6GT	1B5	1G4GT	
3A4	6SD7GT	71A	482B	1D5GT	1G6GT	
6S8GT	10	112A	483	1D7	1H4G	
01A	12A	182B	1A4	1D8GT	1H6GT	
4A6G	14X7	183	1A4P	1F4	1J6G	
6A3	39/44					

FREE! $20.00 List Value Cornell-Dubilier, Mallory, Aerovox, Sprague, Solar, Filter Condensers—ten fast moving filters FREE with each 100 tubes.

39c ea.

3Q4	6AL6	6C5	6K7GT	6SR7	12AX7	12SH7GT	35	50C5
3S4	6AQ5	6C8G	6K8GT	6U6G	12BA6	12SN7GT	35B5	50Y6
3V4	6AR5	6D6	6P5GT	6U6GT	12BA7	12SR7GT	35C5	51
5U4G	6AS5	6F5GT	6SA7GT	6U7G	12BE6	1619	35W4	VT-52
5W4GT	6AT6	6F6GT	6SC7GT	6U7GT	12F5GT	1629 (eye	35Z4GT	56
5X4G	6AU6	6G6	6SG7	6V6GT	12H6	24A	35Z5GT	57
5Y3GT	6AB5	6H6	6SG7GT	6W4	12J5GT	25L6GT	35Z6GT	58
5Y4G	6AH6GT	6H6GT	6SH7	6X4	12J7GT	25X6	36	76
1LA4	6AB4	6B6	6J5	6X5GT	12K7GT		37	77
1R5	6AC4	6BA6	6J5GT	6SJ7GT	6Z4	12K8GT	30	78
1S5	6AC5	6BD6	6J6	6SL7GT	12A8GT	12S8GT	31	80
1U5	6AC5GT	6BE6	6J7G	6SK7GT	12AT6	12SA7GT	32	89
2A5	6AG5	6BH6	6J7GT	6SN7GT	12AU6	12SF5	33	46
2A7	6AK5	6BJ6	6K6GT	6SQ7GT	12AU7	12SF7	34	50B5

69c each

1B3GT	6G5
2A3	6U5
3QS	19BG6G
6A7	
6BG6G	50A5
6E5	807

49c ea.

1C7G	2B7	6AR5	6F5	6T7G	7B5	7G7	7W7	12Q7GT	20	43	
1LA4	5V4	6AS5	6F8G	6T8	7B6	7H7	7Y4	12SG7	32L7GT	50L6GT	
1LE3	5Z3	6AV6	6K7G	6U7	7B8	7J7	10Y	12SJ7GT	35/51	53	
1N5GT	5Z4	6B4G	6R7	6W7G	7C4	7L7	12A7	12SK7GT	35L6GT	75	
1P5GT	6A8	6BA7	6S8	6Y6G	7C6	7N7	12AT7	12SL7	36	84 6Z4	
1Q5GT	6AC7	6B8	6SF5GT	6Z7G	7E5	7Q7	12AV6	12SQ7GT	40	117Z3	
0Z4	1T5GT	6AJ5	6C6	6SS7	7A4	7E8	7S7	12BF6	41	VR150	
1A5GT	1V	6AK5	6D8	6SU7	7A6	7E7	7T7	12C8	42	XXL	
1A7GT	1C5GT	6AL5	6D8G	6Q7GT	7A7	7F7	7V7	12J5	19T8		

59c ea.

1AB5	1LC5	2C34	35Z3	6J8G	6SU7GT	12A6	14B6	14X7	20S1	83
1AD5	1LC6	2V3G	3LF4	6L6G	7A8	12BF6	14H7	35Y4	50C6	117Z6GT
1H5GT	1LH4	2X2	6B7	6L6	7C4	14A7	14N7	45	70L7GT	5881
1LA6	1LN5	2SZ5	6BF6	6S7G	7C5	14AF7	14Q7	2050	81	XXB
1LB4	1S4									

Less than 50 tubes, 5c per tube extra.

Above prices are for 50 tubes or more—may be assorted. Individually boxed—Standard factory guarantee.

50L6, 35Z5, 12SK7, 12SQ7, 12SA7 ..... 5 tubes for $2.19

Miniature tubes 12AT6, 12BA6, 12BE6, 35W4, 50B5 ... 5 tubes for $1.69

1R5, 1S5, 1T4, 3V4 Battery Tube Special ... 4 tubes for $1.29

10BP4TV Picture Tube $17.95 each

12LP4 each $24.95

3S4, 1T4, 1S5, 1R5 ... 4 tubes for $1.29

50A5, 35Y4, 14A7, 14B6, 14Q7 ... 5 tubes for $2.95

Best Quality SPEAKERS Alnico 5 PM

	10 or more Each	Price Each
5"	$.95	$1.05
6"	$1.49	$1.59
8"	2.95	3.25
10"	4.25	4.50
12"	4.95	5.95

2½", 3", 4"—95c - $1.05

Utah Speaker Baffles—completely enclosed for 8" speakers and smaller ea. $2.00
Jobbers: write for quantity prices.

IF TRANSFORMERS

Standard Replacement ea. 29c
Regular size ea. 35c
Midget

Red Hot Vibrator Special. 4-prong, small size Universal, fits 80% of all jobs ea. 89c
Jobbers: Write for quantity price.

4 PRONG VIBRATORS—VERY BEST BRANDS
Standard replacement Sensational Value $1.29 ea.

OCTAL SOCKETS 10 for 49c
MINIATURE TUBE SOCKETS 10 for 49c

CRYSTAL CARTRIDGE
Standard replacement crystal cartridge. Each $1.39

RESISTORS
100 resistors—packed in a box IRC etc. Best values only—½ watt, 1 watt, 2 watt $1.98

SELENIUM RECTIFIERS
Standard 100 mil. Each 79c

PUSH-BACK WIRE
100-ft. rolls 39c each

OUR NEW ADDRESS

PREMIER RADIO TUBE COMPANY
551 West Randolph St., Chicago 6, Ill.
Phone: Andover 3-1590
"Your Tube Source Since 1926"

NEW TEST EQUIPMENT

All makes, all models. Tell us what you need and we will quote best prices.

RF and Antenna Coils, Standard Broadcast Band 29c ea.

VOLUME CONTROLS

	10 or more Each	Price Each
VERY BEST BRANDS		
½ meg. or 1 meg. or 1.10 meg. with switch—long shaft	29c	35c
2 meg. for battery sets—switch, long shaft	29c	35c
½ meg., 1 meg., 1.10 meg. or 2 meg., long shaft, less switch	16c	19c

BY-PASS CONDENSERS

100 Condensers assorted in package $5.95

.001	600 V	ea. 6c
.002		ea. 6c
.005		ea. 6c
.01		ea. 7c
.02		ea. 7c
.05		ea. 8c
.1		ea. 9c

400-VOLT BY-PASS CONDENSERS

.05 mfd.	ea. 6c
.2 mfd.	ea. 6c
.25 mfd.	ea. 10c
.5 mfd.	ea. 15c

BUFFER CONDENSERS
.005 mfd. 1600 WV / .008 mfd. 1600 WV / .01 mfd. 1600 WV 15c ea.

VARIABLE CONDENSERS
Two gang for superhet Standard ¼" shaft 69c

SPECIALS

OUTPUT TRANSFORMERS

For 5DL6, etc. 39c ea.
For 6V6, 6F6, 3Q5, etc. 45c ea.

UNIVERSAL OUTPUT TRANSFORMER SPECIAL
Up to 12 watts to any speaker (while they last) 98c ea.

Special on No. 47 Pilot Lights Only—100 Bulbs...$3.95 Box of 10...49c

PILOT LIGHTS—100 BULBS $4.90

1 box of 10 bulbs 54c

No. 40 6-8 V, 15 Amps.	No. 44 6-8 V, 25 Amps.
No. 41 2.5 V, 50 Amps.	No. 46 6-8 V, 25 Amps.
No. 51 6-8 V, 20 Amps.	

6-FT. LINE CORDS

Good Rubber with plug. 10 for	Underwriters' Approved. 10 for
$1.25	$1.69

TV PARTS

TV Antennas:
Conical price leader with 5-ft. mast $5.75
World's Best Delux Conical with 9-ft. mast and heavy cast fittings 8.95
Hi-Lo folded dipole array, 6-ft. mast 6.95
100-ohm line $1.95 per 100 ft. $14.95 per 1000 ft.
Horizontal output, RCA Type Flyback $3.45 ea.
Discriminator Transformers 1.25 ea.
TV Screen Filters with suction cups | 10" $1.17 | 12" 1.95 | 16" 2.55 | best quality IND. BOXED for highest re-sale value

FILTER CONDENSERS

Very best brands
Fresh stock
10 or more assorted 5% discount

450 Working Volts

5—450 V	ea. 21c
10—450 V	ea. 24c
10—450 V w/20-20—25 V	ea. 29c
15—450 V	ea. 29c
20—450 V	ea. 35c
30—450 V	ea. 49c
30—450 V with 20-20—25 V	ea. 59c
8-8—450 V	ea. 35c
8-8—450 V-50-50 V	ea. 35c
8-8-8—450 V	ea. 39c
8-8-8—450 V-50-50 V	ea. 43c
10-10—450 V	ea. 43c
20-20—450 V	ea. 49c

150 Working Volts

10-10—150 V	ea. 24c
10-10-10—150 V	ea. 29c
15—150 V	ea. 21c
16—150 V	ea. 23c
20—150 V	ea. 25c
30—150 V	ea. 29c
40—150 V	ea. 29c
15-15—150 V	ea. 29c
20-10—150 V	ea. 24c
20-20—150 V	ea. 29c
20-20-20—150 V	ea. 39c
10-20—150 V	ea. 29c
10-10—150 V	ea. 35c
20-20—150 V	ea. 35c
40-10—150 V-30-20-25 V	ea. 35c
40-40—150 V	ea. 39c
40-40—150 V 20-25 V	ea. 39c
50-10—150 V	ea. 35c
50-50—150 V	ea. 39c
60-60—150 V	ea. 39c
20-15-10—150 V Sprague type	ea. 35c
25-25—150 V-200-10 V Cathode Condensers	ea. 35c
10—25 V	16c ea.
20-20—25 V	
20-20-20—25 V	
20—25 V	
10—50 V	
100—25 V	

Rated accounts—10 days—all others 20% deposit with order, balance COD. Minimum order $5.00. All shipments FOB Chicago. Prompt attention paid to foreign orders. ORDER TODAY. Our parts and tubes are warranted to be 100% replacements for the prototypes in the listings above. Satisfaction Guaranteed. To speed up delivery, sign your order and your remittance with the same name.

NEW TV PRODUCTS on the Market

DU MONT INPUTUNER

The Electronic Parts Division of *Allen B. Du Mont Laboratories, Inc.* of East Paterson, New Jersey has announced a new four-section Inputuner which incorporates the latest *Mallory-Ware* spiral-type Inductuner.

According to the company, the foremost advantage is its ability to double the gain and provide increased selectivity over previous models. The tuning range is continuous from 54 to 216 mc., inclusive, covering the TV channels 2 to 13 as well as the FM band. The new Inputuner which requires only 5.9 turns of tuning motion as against 10 turns for previous models provides an improvement in the high-band spread. A new type dial illuminates the TV channel numerals on an outer circle and then automatically switches the illumination to the FM designations on an inner circle when the tuner traverses the FM band.

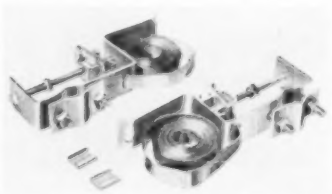
The unit is completely shielded and is supplied complete with tubes, new-type dial, and escutcheon.

"UNIMAC" MOUNT

Marvin Radio-Television of 89th at Buckeye Road, Cleveland 4, Ohio, has developed a unique unit which facilitates the erection of TV and FM antennas.

Known as the "Unimac" chimney antenna mount, the new unit requires only the use of one bolt on each of two units to lock-clamp the steel strapping in place and take up the slack. One wrench and a single operation add to the safety factor of this installation.

Constructed of heavy gauge, weather protected metal, the "Unimac" sets are made of two pre-assembled units,



which come complete with all hardware and two twelve-foot bands for secure installation on even the largest chimneys. Any mast with a diameter of ¾ to 1¾ inches can be accommodated.

TELEVISION AMPLIFIER

The new Model 212TV amplifier, manufactured by *Spencer-Kennedy Laboratories, Inc.*, 186 Massachusetts Avenue, Cambridge 39, Mass., has been specifically designed for television use. This single untuned amplifier has a bandwidth of 40 to 240 mc. and a gain of 20 db. into a 72 ohm unbalanced load, and 25 db. into a 300 ohm balanced line.

Capable of replacing up to twelve single channel TV or FM amplifiers, it has a transmission characteristic of

± 2 db. over the bandwidth and an impedance of 200 ohms. In addition to an integral power supply, transformers can be supplied to match 52, 72, and 93 ohm unbalanced and 300 ohm balanced lines.

Owing to the traveling wave circuit used, a tube failure does not mean amplifier failure, but only a loss of 0.7 db. in gain. Compact and simple in construction, the Model 212TV amplifier can be safely left unattended over long periods of time in television distribution systems in hotels, apartment houses, restaurants, sales rooms, and television sets in fringe areas. Full data on this unit is available from Dept. RT at the Cambridge address.

TWO NEW ANTENNAS

Two completely new antenna models, the "Versacone" and the "Jacknife" have been unveiled by *Radio Merchandise Sales, Inc.*, of 550 Westchester Avenue, New York 55.

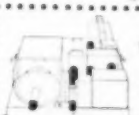
The "Versacone" is a conical, all-channel antenna which is readily adaptable in various arrays by the simple shifting of rods in the reflector and insulator plates.

The "Jacknife" model was designed to provide a completely pre-assembled, all-channel antenna that has no loose parts and requires no manipulation of the rods, in conical, folded, and straight dipole models.

ALL-ALUMINUM CONICALS

JFD Manufacturing Co., Inc. of 6101 Sixteenth Avenue, Brooklyn 4, New York is currently in production on a newly-designed, all-aluminum conical antenna which has been named the "Commandair."

The antenna features heavy-duty element brackets with extra-long gripping surfaces for secure anchoring of elements, all-aluminum, corrosion-resistant construction for greater stamina and longer life, elements of heavy-wall aluminum tubing for added



Stupendous! Gigantic! Colossal! BARGAINS in RADIO EQUIPMENT

AUDIO AMPLIFIER Push-Pull triode amplifiers having 2 of the valuable and scarce sunset type hypersil core audio transformers that sell for over $10.00 each. Neat aluminum case, fully enclosed. Perfect for intercom systems, phono, mike, or signal tracer amplifier for testing radio. A $25.00 bargain at only **$3.40** each.

RT1463 7 tube amplifier containing 3-7F7, 1-7Y4, 3-7N7, 4 potentiometers, numerous resistors, filter and bypass condensers, filter chokes, power and audio transformers, and six sensitive plate relays. A military development that provided amazing stepless control proportional to correction required for ailerons, rudder and elevator, in the original application. A control amplifier of the ordinary type would deflect the rudder by some arbitrary amount when the ship was blown off the course to port or starboard. The result would either be that the correction was insufficient and the plane continued off course, or the correction would be too great, starting a series of tackings that would greatly increase fuel consumption and elapsed time in reaching the objective. This phenomenal unit, with its 3 amplifiers and six 5000 ohm relays in bridge circuits, will accurately control any 3 operations, related or unrelated, in minutely adjustable uniquely quantitative variations in either forward or reverse directions. 9"x7"x9" black crackle aluminum case. Brand new in original carton. **$9.95.**

Universal 4 lead broadcast band oscillator coil (can be converted to 3 lead type by addition of jumper). Ten for **$1.00.**

TOROIDAL COIL FILTERS

Are the Answer to Any Network Problem

- SHARP CUT-OFF • COMPACT
- LOW INSERTION LOSS • HUM PROOF
- HIGH STABILITY • HIGHEST "Q"
- 1000 CYCLE AUDIO FILTERS
- "Q"-55 AT 1000 CY.; 150 AT 3000 CY.

Navy FD52010.1 low pass audio filters that are the exact electrical and physical equivalent of commercial audio filters selling for $25.00 wholesale. Far superior to surplus Radio Range Filters now being offered. Twice as selective as Q-fiver section of 274N, which has previously provided the amateurs highest standard of interference elimination. With diagram **$2.00**

THE BUFRAD SECTIONAL TOWER

This latest addition to the famous line of BUFRAD antenna products makes up to a hundred foot tower from any desired number of ten foot sections of extremely strong welded construction. The sections are shipped assembled and painted, so that erection is a matter of minutes rather than hours. Assembly is a one man job, and is accomplished by climbing up the completed portion of the tower with the next 25 lb. section to be installed. Hand and footholds are provided to make the work safe and easy. Cap at top of tower provides bearing surface for rotating, and prevents water from entering tubes. Useful for police, or amateur transmitters, and in addition the tower will provide satisfactory TV reception where otherwise it would be impossible. Ideal for supporting permanent or temporary power lines, wind generators, stadium public address speakers or spotlights for gas stations or parking lots "B" and "C" sections together cost a total of $15.75 and total 20 feet. "A" sections, which make up the entire tower except for the top, are each 10 feet long and cost but **$12.75** apiece. Those who wish a mast base will be able to obtain one (not shown above), for only **$6.75.** The base is especially useful when erecting the tower on a sloping roof.

P.M. SPEAKERS

Latest type PM Speaker in a fully-enclosed metal cabinet. Speaker and case match communication receivers, in addition make perfect intercom remote stations. **$4.50.** Including output transformer **$4.95.**

HEAT GUN

Red plastic, streamlined, pistol grip heat gun. Blasts 180° hot air at 20 cu. ft. per minute. Big rugged vacuum cleaner type AC-DC motor that also blows cold air. Use to clean radio chassis, heat carburetors, dry ignitions, quick-dry paint, thaw out radiators or water pipes, etc. Guaranteed or money refunded if returned, prepaid, in 5 days. **$12.95**

Sensational Value in AC-DC POCKET TESTER

This analyzer features a sensitive repulsion type meter in bakelite case. The result of 15 years in the instrument field by a large company specializing in electronic test equipment. Specifications of the AC-DC Model Volt-Ohm-Milliameter: AC-Volts 0-25, 50, 125, 250; DC Volts—0-25, 50, 125, 250; Milliamperes AC—0 to 50; DC Milliamperes—0 to 50; Ohms Full Scale—100,000; Ohms Center Scale—2400. Capacity—.05 to 15 Mfd. Total Price, prepaid in the USA—**$7.00.** Similar DC Meter, without the AC operated ranges of above. **$5.50** prepaid.

RT 1579 WITH TUBES, DIAGRAM AND PARTS LIST

$14.95

Consists of three stages (cascade 6SJ7's and 6F6 output stage) high gain, high fidelity amplifier with 60 cycle 110V power supply on same 13½ x 14½ chassis, which is protected by substantial steel cover over tubes and parts. Made by Western Electric with typical quality components such as husky power transformer and oil condensers. This unit is obviously intended to give years of trouble-free service with no more need for repairs than a telephone. Disconnecting one wire each from the special tuned input and output filters results in as high a fidelity amplifier as can be obtained

"DRILLMASTER" ELECTRIC DRILL

Low-priced electric drill, ideal for hobbyists. Complete with sander, buffers, grinding wheels, etc. Quantity limited. **$9.95.** Satisfaction guaranteed or money refunded if returned prepaid within 5 days.

POWER RHEOSTAT

Exceptionally Rugged. Trouble-free design. Withstands severe overloading to many times 25 watt rating without burning or smoking. Perfect motor speed control or line voltage adjuster. 3 sizes available: 50, 60 and 200 ohms. Regular price $5.20. Special—**$1.00.**

RT1655

Only **$14.95**

11 tube crystal-controlled **super-heterodyne** receiver that covers the FM band. The ultra modern circuit uses the latest type of tubes including 7 miniature 6AJ5's. Beautiful chassis and aluminum cabinet. Tubes and diagram included.

T-32 Microphone with desk or table stand **$2.95**

SOS EMERGENCY TRANSMITTER

Famous Gibson Girl Transmitter that saved so many lives during the war. Distress call transmitter for boats and airplanes. No external power supply required for operation. It is merely necessary to turn the crank on the top of the transmitter and power is generated and the distress signal is automatically sent out on international distress frequency. Brand New Gibson Girl Transmitter complete with tubes. $9.95.

ANTENNA KIT

For Gibson Girl transmitter. 300 ft. antenna wire, 2 balloons, 2 hydrogen generators, box kite for windy weather, searchlight. Complete kit.

$9.95

CLEARANCE BARGAINS

MICROPHONES

Super Special—Highest quality all chrome bullet shaped CRYSTAL MIKE of top-flight nationally known brand **$5.95**

BULLET DYNAMIC MAKE **$7.95**

MIKE Jr. 60c

PUSH-TO-TALK MIKE with switch on handle 98c

LAPEL MIKES — Specify whether carbon or magnetic 93c

T-32 MIKE with desk or table stand $2.95

3-Gang Broadcast Band Permeability tuner. Was $3.50. Now $1.50.

Supreme Instruments Corp. Model 592 Volt-Ohm-Milliameter. Either 25000 or 1000 ohm per volt.

Sensitivity at the throw of a switch: 44 Ranges at your fingertips. The outstanding tester of all time. Send for folder and compare to see how it is unbeatable. Regularly **$58.95.** Special **$48.95.**

WE WILL PAY CASH

for SCR284, BC654, PE103, BC348, BC312, BC222, BC324, and BC342 receivers. SCR522 and BC610 transmitters. We are especially interested in any factory, dealer or other outlet submitting a list of surplus electronic equipment for us to bid on.

SIGNAL GENERATOR

Genuine Laboratory-type precision signal generator. Manufactured and sold for [illegible] each in large quantities during the war by Northeastern Engineering Corp., one of the top manufacturers of electronic equipment for the U.S. Govt. Five fundamental bands starting at 150 KC. Strong harmonics up to 120 MC. Five step ladder type attenuator as well as potentiometer output control. Regular 1000 cycle audio oscillator using vacuum tube, not a cheap neon saw tooth audio oscillator. Audio output separately available externally. Weight without packing material 16 lbs. which should show what a world of difference exists between this signal generator and the ordinary cheap oscillator used by the average serviceman. Complete with fused plug and coaxial output lead. Super Special **$38.75.**

1. AUDIO AMPLIFIER

Undreamed of value. Uses 6V6's. Has 4 microphone inputs brought to jacks at rear panel. Various output impedances available at rear panel connections. Steel case with chrome handles. 9" long x 9" high x 6" deep. Tubes included. Shipping weight 20 lbs. **SUPER SPECIAL**—[illegible] while supply lasts.

Bandswitching Tuning Turret

4 bands above 100 Mc. #14 silver plated coil wire. Tuning condensers, driving motor diagram included. Only **$2.95.**

HURRY

Set your 2 gang midget superhet tuning condensers with ¼" shaft and trimmers. Reg. $1.25 each, now 5 for **$2.00.**

DELUXE SUPERHET A.C.-D.C. RADIO KIT

Extra high quality standard production line radio in kit form with complete instructions. Features 2 iron core I.F. transformers, a 2 gang condenser, and polyethylene insulated edgewise wound antenna loop. Tubes include 12AT6, 12BA6, 12BE6, 50B5 & 35W4. Receives broadcast band from 550 to 1700 KC.

Kit form **$8.75** or 2 for.... **$17.00**

Assembled, Wired & **tested**
$12.95 or 2 for.......... **25.00**

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. RN-2 BUFFALO 3, N.Y.

strength, and dipole insulators made of bakelite for permanently stable anchoring of elements.

Three models of the "Commandair" are available, the Standard Conical, Conical with High-Frequency Element, and Conical with Three-Element Dipole. All are available in either single bay or 1/4 wavelength stacked arrays.

Literature describing the complete "Commandair" line is available either from the manufacturer, or *JFD* distributors and dealers.

ALL-BAND CONICAL

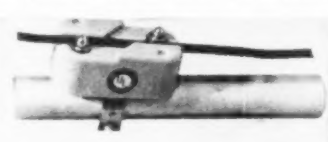
The new "Mighty-X Skyhawk," introduced by *Cornell-Dubilier Electric Corp.* of South Plainfield, New Jersey, features efficiency on all bands plus only a five-minute assembly and installation job.

The new television antenna is available in two models, the LZX-2, a 2-bay package complete with an 8-foot mast, and the Model LZX, a single-bay package without a mast. Separate wavejumpers for stacking are available as accessories.

LIGHTNING ARRESTER

A new twin-lead lightning arrester, designed to protect valuable television parts against lightning and static charges, has been introduced by *JFD Manufacturing Co., Inc.*, of 6101 Sixteenth Avenue, Brooklyn 4, as the "safeTVguard."

This new arrester carries the *Underwriters' Laboratories* approval for both indoor and outdoor use. It can be installed on the mast, on a grounded pipe, wall or window sill, and other flat surfaces. No special tools or experience is required to install the arrester. The twin-lead is merely slipped into the horizontal slot on top of the arrester and tightened in place



by a pair of cap nuts and toothed washers.

The discharge contacts are sealed in rare gas tubes to dissipate charges that might cause damage. The lead-in's 300 ohm impedance remains unchanged. Glazed porcelain construction resists temperature and humidity changes. All hardware is solid brass and nickel-plated for greater corrosion-resistance.

BACE CONSOLE

Bace Television Corporation of South Hackensack, New Jersey has added a new line of 16- and 19-inch home receivers for 1950.

Among the features incorporated in the new line is a built-in antenna. The (*Continued on page* 159)

FIX ANY RADIO

Amazing New Invention

Find radio faults with a new simplified method. Repair all radios in minutes instead of hours. Revolutionary, different *Comparison* technique permits you to do expert work almost immediately. Most repairs can be made without test equipment. Simplified point-to-point, cross-reference, circuit suggestions locate faults quickly and easily.

PRICE ONLY $1.50 COMPLETE

NO TESTERS NEEDED

Locate trouble in all sets without test equipment. Make needed tests, measure voltage, check tubes, trace signal, using only a 5c resistor, condenser, and crystal detector. Data on all radios, portables, AC-DC, intercoms, FM, P.A., etc. Free trial. Send coupon today.

PICTURES, BLUE-PRINTS, CHARTS, TESTS, HINTS

Learn time-saving trouble-shooting short-cuts; find any radio fault with ease. Follow the tests shown on 24 large circuit blueprints. Over 1,000 practical repair hints. For all types of radios. Hundreds of simplified tests using a 5c resistor and any filter condenser. Introductory material for beginners and to serve as review for experienced radio men. Several chapters on test equipment. Complete plan in manual form. 63 job sheets, 84 pages, data on all tubes, large size: 8½x11 inches. Schematics, pictures, charts. Sold on no-risk trial. Use coupon to order.

1949 1948 1947 1946 1942 1941 1940 1939 | 1926-1938

SUPREME Most-Often-Needed RADIO DIAGRAMS | **RADIO**

Each Manual has an average of 194 pages of diagrams, alignment data, voltage values, parts lists, and service hints: large size, 8½"x11". To order, see coupon—▶ | **Diagrams 240 Pages Price, $2.50**

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FEBRUARY SPECIALS

Please write for our 1950 complete catalog.

TUBE SPECIAL

5CP1—5" CATHODE RAY TUBE, 4 for $4.25 ..... $1.45 each

SCR-522 EQUIPMENT

SCR-522 TRANSMITTER-RECEIVER, with tubes. Excellent condition $60.00
PLUGS—Set for SCR-522 ..... NEW 3.75
PE-94C—24 Volt Dynamotor. Used $2.50 ..... NEW 4.50
BC-602 Control Box ..... NEW .95
BC-651 Jack Box ..... NEW .79
AN-104A Antenna
NEW STEEL $1.95 ..... COPPER 2.95

SECOND POWERED HEAD AND CHEST SET. Made by Automatic Elec. Co. ..... PAIR $11.00
NEW—EACH 5.95

ELECTRONIC MEGAPHONE — Light weight portable for use by coaches, cheer leaders, police, fire depts., etc. Ready to operate, includes BK-60 Speaker, BC-611C Amplifier, Carrying Case, and batteries $39.50
BC-611C AMPLIFIER only 9.95

BASSETT AIRCRAFT RADIOS & ACCESS

Two Way Radio Freq. 3105 K.C.

ALL NEW EQUIPMENT

MC4—11 Watt Trans-Rec., Tubes, crystal, battery case, antenna $31.50
MC4B—8 Watt Trans-Rec., Tubes, crystal, clipsnack, antenna, 12 volts 44.50
MC4A Receiver Range, weather and tower freq. 13.50
MC4T Aircraft Microphone 4.95
HEADSET and PLUG 2.95
MODEL TR 15—Trailing Antenna Wire Set 6.95

WESTON ELECTRICAL TACHOMETER METER, Model 545 for use with Model 724 magneto. Speed 0-2,000 R.P.M. Ratio 2:1 ..... BRAND NEW $17.50
WESTON TACHOMETER GENERATOR, Model 724, Type C ..... GOOD USED 16.75

BC-464—TARGET RECEIVER—5 Channel remote, battery case, antenna 68-75 Mc ..... NEW $14.95
INTERPHONE AMPLIFIER — CMX50128A, 12 V. 6 Watts P.P. T.C.S. Equipment—tubes and dynamotor 8.50
HANDY-TALKIE Crystal and Coil Sets—1885 K.C. to 5,500 K.C. Specify frequency—2 crystals and 2 coils per set ..... NEW 2.25

PE-103 DYNAMOTOR POWER SUPPLY. COMPLETE with dynamotor, filter, relay unit, battery cables, and shock mount. Part of SCR-284. BRAND NEW $19.50

BC-620 Mobile FM Transceiver—P. O. SCR-619. Includes 10 meter band. Excellent condition with tubes $11.95
PE-120 Power supply with tubes—Excellent condition 5.50
Combination BC-620 and PE-120. Both for 14.95

FL-8 Range Filter ..... NEW $1.95
HS-23 HEADSET—BRAND NEW 8,000 ohm with ear pads 2.45
HS-33 HEADSET—With ear pads 1.29
HS-30 HEADSET—Complete with matching transformer, 6' cord and PL-55 plug ..... NEW 1.95
HS-30 HEADSET ..... .95
DYNAMIC HEADSET AND MIKE—P.O. Mark II ..... NEW 1.95
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HEADSET ADAPTER MC-345D—High to low impedance ..... NEW .35
T-17 HAND MIKE ..... NEW 1.95
T-12 DESK MIKE. USED $1.95 ..... NEW 3.00

MN-26C—BENDIX RADIO COMPASS, 150-1,500 K.C. Tubes—Excellent cond. $17.50

TRANSFORMERS—6200 V. @ 225 ma. secondary—easily C.T. for 3100-0-3100 @ 650 ma.—Primary 105/110/115 V., 60 cycles—American Transformer Company ..... NEW $39.50
2.5 V. @ 10 amps. C.T.—15,000 volt insulation—115 V. A.C. primary—Kenyon S-565 ..... 5.95
200-0-200 @ 50 ma.—6.3 V. @ 3 amps, 115 V. A.C. Primary ..... NEW 1.95
115 V. A.C. Primary—700 volts C.T. @ .075 amps; 6.3 V. @ 1.2 amps; 5 V. @ 3 amps ..... NEW EA. 2.25
WELDING TYPE W. TRANSFORMER—190 amperes—5 volt secondary—115 V. A.C. primary, mfg. by American Transformer Co. ..... BRAND NEW 16.95

INTERPHONE AMPLIFIER—BC-789—Ideal for Aircraft, booster for telephone system, etc. ..... NEW $4.50

400 Cycle INVERTER—G.E. 5BZ1N3A. Input 27 V., 25 amps. Output 115 V., 1.75 A.A. single phase $12.50
400 Cycle INVERTER—G.E. PE-218 Input 27 V., 100 amps. Output 115 V., 1,500 V.A. single phase ..... NEW 29.50
800 Cycle INVERTER—PE-206 ..... NEW 5.95
800 Cycle Blower and Motor—1 ph 6,700 R.P.M. 120 V. CAY-21773 ..... 1.50
24 V. D.C. Blower and Motor—1700 R.P.M.—1.55 amps. A. G. Redmond Co. 1.95

T-47/ART-13 TRANSMITTER with operating manual. GOOD USED $200.00. NEW $295.00

APN-1 ALTIMETER INDICATOR, basic instrument 0-1 m.a., 5 ma. shunt, 270° dial. An excellent basic movement for constructing your own meters. ..... NEW $1.95
METER RECTIFIER, full wave, midget Selenium 10 volts, 30 ma. ..... .29
APN-1 ALTIMETER, Complete ..... NEW 34.50
I.F. Transformers—1st, 2nd or 3rd, from SCR-522, 12,800 K.C. Iron Core tuning, can be tuned to television I.F. Frequency by removing pedder cond. 2 for $1.00 ..... EACH .35

BC-348 Mounting Base $2.25
BC-348 Socket Plug ..... .69
BC-348 Mounting Base and Outlet Plug 2.50

TEST EQUIPMENT

BC-221 Frequency Meter, 125 K.C. to 20,000 K.C. Excellent Condition $69.50
I-122 Signal Generator by Eico 30% Co. 79.50
I-177 Tube Tester 19.50
1-cyl. Calibrator, 115V., 60 cycles, 245 and 1,000 K.C. Crystals, Electro ..... NEW 19.50
TS-13 AP. Type 1 ..... 49.50
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Signal Generator ..... BRAND NEW 29.50

IDEAL MOBILE POWER SUPPLY

PE-237 Dynet driven power supply 6, 12, or 24 V. Input 155 V. @ 90 ma., 315 V. @ 120 ma., 6.3 V. @ 5.0 amps, 6 V. @ 3.0 amps. 1,400 to 2,800 volts @ 1.5 ma. NEW $27.50
450 ma. 800 tubes, shock mounted ..... BRAND NEW $27.50

NINE OUTLET BOX 9-0-9-0-9 Used for testing metal, underground wires, gold, etc. NEW WITH 90 VOLT BATTERY $59.50
USED, EXCELLENT COND. 39.50

SUPPLUS RADIO CONVERSION MANUAL. Explains conversion of command sets and how to use them $2.50
TS-323/UR U.H.F. Frequency Meter, 100 to 156 mc. 1.95
SPEAKER—Permanent Magnet Dynamic, 3½" PM Concentrator, 25 watts, input impedance 4 ohms. Waterproof. Excellent Used 8.95

TERMS: Prices f.o.b. Pasadena. 25% dep. on all C.O.D. orders. Conditions and 20% sales tax.

Crystal Diode Meter

(*Continued from page 35*)

which is transformed to a suitable impedance level for driving the detector circuit by the small pickup coil, L_2. The detector circuit resembles that of a cascade voltage multiplier, but due to the impedance level at which the diodes operate, this multiplying action takes the form of an effective current gain of approximately 1.5 times, or slightly over 3 db. To assure effective multiplying action, condensers C_{12} and C_{13} are made sufficiently large so that the time constant of the diode load circuit is considerably longer than the period of one cycle of the signal voltage, at the lowest frequency to which the instrument will respond.

The indicating meter is a *Weston* Model 301 50-microampere instrument having a d.c. resistance of 1100 ohms. As the meter itself is of relatively low impedance and constitutes the total load into which the diodes operate, the dynamic impedance of the latter at the lowest signal levels encountered may become only slightly less than the effective load resistance, and the rectification efficiency for small signals is impaired. For this reason, the diodes are connected in parallel pairs, with a resulting increase in forward conductance, and a material gain in over-all sensitivity. While pairing of the diodes in this manner may infer that accurate matching of diode units is required, it has been found that virtually any 1N34 units will provide satisfactory operation in this circuit.

The over-all increase in sensitivity over the conventional series diode detector circuit, afforded by the features described above, ranges from 3 db. at half meter scale to slightly over 6 db. at full scale. The actual gain obtained will depend to some extent upon the forward characteristics of the particular diodes used, and the figures given are representative of the performance to be expected with standard 1N34 units. While the dynamic range of the instrument is reduced somewhat by increasing the full scale sensitivity in this manner, it has been found that the range of slightly over 16 db. is adequate for most antenna gain measurements, and as will be pointed out, this dynamic range can be increased by the use of a capacitive voltage divider. With the particular set of diodes used in one model of this instrument, the full scale sensitivity was 150 millivolts, and a useful indication was obtained at a level of 20 millivolts.

In order to increase the versatility of the field strength meter, the over-all dynamic range is extended to 46 db. by including an attenuator network between the coupling circuit and the detector circuit. Because of its freedom from frequency effects and resistive loading of the tuned circuit, a capacitive ladder-type attenuator consisting of condensers C_1 through C_{11} is used.

The series elements C_4 C_{10}, C_7 C_{11}, and C_8 C_9 are semi-variable, and are adjusted to provide a 10 db. change in level for each step of the scale multiplier switch, S_1.

As a purely precautionary measure, a meter shunting switch is included for use during initial adjustments. Due to the sensitivity of the instrument and the meter itself, it is readily possible to exceed the maximum rated current through the microammeter by several hundred per-cent when the device is used in the presence of a strong r.f. field. The shunting switch allows a full scale current multiplication of five times, and provides a measure of protection against accidental meter damage. It should be noted, however, that the scale calibration with the shunt connected will not be correct, and the instrument should not be relied upon to give direct power ratios under these conditions.

Construction and Calibration

Construction of this instrument is simplicity itself. Almost any physical arrangement may be used, but as a matter of convenience, the whole assembly may be built into a standard three-inch, sloping front meter case. The small components, condensers C_{12} and C_{13}, resistors R_1 and R_2, and the four 1N34 germanium diodes are mounted on a 2" x 3" terminal board, which, in turn, is secured to one side of the case near the rear panel. The tuned coupling circuit, L_5, L_6, and C_5 is mounted to the top flat portion of the box near one corner, and the tuning adjustment allowed to protrude from the top. The pin jack for the 2-foot rod antenna is located on the top of the box in the opposite corner. Switches S_1 and S_2 are placed on the lower apron in any convenient position. The adjustable calibrating condensers C_3, C_4, and C_5, together with the remaining attenuator condensers, are mounted on the rear wall on a second terminal board, in such a position that the adjustments are accessible. Insofar as possible, all r.f. grounds are returned to a common point under one of the mounting screws for the coil assembly L_1, L_2. The underchassis view shows the general layout of the parts in the case.

While the particular instrument described was constructed specifically for the 3.5 to 4.0 megacycle band, other ranges may be substituted, and a possible further refinement might be to include some form of bandswitching integral with the unit. Since the frequency characteristics of the 1N34 diodes allow their use up to about 500 megacycles with little change in rectification efficiency, good performance may be expected from this instrument through the v.h.f. bands, although such operation has not been attempted. Coil winding data for the 3.5, 7, 14, and 28 megacycle bands is given in Table 1.

Calibration of the meter scale is best accomplished at a level of approximately one volt. Full scale (50 microamperes), is arbitrarily designated

as zero db. The input level is reduced in one db. steps from that required to produce full scale deflection, and the corresponding current values recorded. It will be found that the resulting db. scale will be approximately linear down to the —10 db. point, or about 5 microamperes, below which the calibration becomes cramped. A scale reading to —16 db. is, however, quite practical. The range multiplier condensers may then be adjusted to produce —10, —20, and —30 db. attenuation by increasing the input level accordingly.

In conclusion, one point in connection with the use of any field strength meter for antenna measurements might be brought out. Inasmuch as a radiating system sets up a strong magnetic field which surrounds the wire for a distance of ¼ wavelength and attenuates rapidly beyond, it is advisable for best accuracy to locate a field indicating instrument outside of this ¼ wavelength limit. At the lower frequencies, i.e., 4.0 megacycles or so, this means that the field strength meter should be located a minimum of perhaps 75 to 100 feet from the plane of the antenna. The sensitivity of the instrument described is such that, with a pickup antenna slightly over 2-feet long, a usable indication can be obtained at a distance of 150 feet from a 25 watt mobile transmitter on 3.9 megacycles, and it is considered that the measurements taken in this manner are entirely valid. —30—

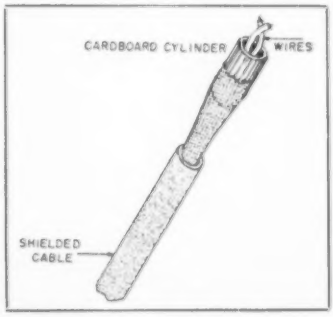
SOLDERING TO SHIELDED WIRE

By HUGH LINEBACK
Ass't Prof., Oklahoma A. & M.

WHEN a shielded cable is cut, one of the most difficult soldering tasks is to tin the shield, or to solder a ground wire to it without damaging the insulation. Of course, it is usually better to fish the wire out of the shield by spreading the weave several inches back from the end, but when this cannot be done the method shown in Fig. 1 can be used.

The shield is pushed back a little to loosen the weave, and a cylinder of cardboard inserted around the wires. Insulating paper used in motors and transformers is excellent for this. Then when the solder has cooled the cylinder is removed. —30—

Fig. 1.



nel of 5.960, heard in the United Kingdom 1600-1700.

Ceylon—Colombo, 4.900, heard with BBC news relay 1100. (Pearce, England) Closes 1200 with "God Save the King."

China—"Voice of Free China," Taipeh, Taiwan (Formosa), has moved from 11.725 to 11.800, with schedule of around 0500-1130; since the capital of Nationalist China is now at Taipeh, it is likely that this outlet—announced at BED2 and BED4—will add *English* to its broadcasts. Most likely times for it to carry *English* news are 0900, 1100. Balbi, Calif., says the 2300-0100 daily beam to the U. S. on 15.235 has been heard lately at better level; news 2300-2320, commentary 2330; last hour is in Chinese. Here in the East there is QRM from Tokyo on same frequency.

Shanghai still heard on 5.985 but does *not* take *English* 0830. (Dilg, Calif.)

Former Peiping, 10.260, now announces as Pekin. (Dilf, Calif.) Still heard in East signing on 1800. (Sutton, Ohio) Has terrific CWQRM and other interference.

Curacao—Contrary to widely-circulated reports abroad, PJC-2, Willemstad, was still on 5.010, heard 1840, at the time this was compiled. Could not be found on 7.250 to which channel it had been reported to have moved. (Hankins, Pa.)

Cyprus—Sharq-al-adna, 6.170, Limassol, noted 0000 in Arabic. (Gainer, Maryland) The 9.650 channel noted around same time at weak level. (Fargo, Ga.) The 6.790 channel heard 1400-1445 in Newfoundland. (Peddle)

Denmark—An official of OZF, 9.520, Copenhagen, informed Worris, N. Y., that arrangements have been made for the last 30 minutes of the daily 2200-2230 transmission to be "fixed" *English* program. This has been effected. The station asks for reports and comments on the new arrangement. The girl announcer, Marianne, in introducing this last half hour says it will be entirely in *English* "and not a *word* in Danish"; at sign-off she concludes with her customary "Glad to have you listen."

Dominican Republic—HI4T, 5.970, and HI2T, 9.735, now sign-off 2300, one hour earlier than formerly. (Balbi, Calif.)

Finland—Helsinki informs Halvorsen, Norway, its schedule includes 1925-1935 news and press review in *English* on 17.800 to South America and Southwestern Europe; 0715-0725 news and press review in *English* on 6.120, 9.555, 15.190, 17.800, to U.S.A., South America, and Southwestern Europe; these are *weekdays only*; 1245-1255 news and press review in French on 17.800 to South America and Southwestern Europe, and to same area in French 1700-1715 on 17.800, 6.120. Re-

ports on these transmissions would be appreciated by the Finnish Broadcasting Corporation, Helsinki, Finland.

France—Paris, 6.145, heard in German 0030-0045, 0130-0145, fair level in California. (Balbi)

Paris has replaced 11.700 with 7.280 in parallel with 9.550 to North America (*English*) 1945-2000. (Parsons, Pa., Arthur, W. Va., others)

French Equatorial Africa—Brazzaville, 17.837, noted 1545 with *English*. (Cox, Delaware)

French Indo-China—Saigon, 11.78 heard in Britain from 1815 with news in French (*Le Journal parle*), recordings; news in *English* 1845-1900, then program in Chinese or Ammanese. (Pearce) Heard here in West Virginia signing on 1800 with "La Marseillaise"; has bad CWQRM; should have *English* both at 1845, 1930.

Germany—DTSP, 15.280, Munich, has winter schedule of 1045-1100 point-to-point with the "Voice of America" in New York; radio and press review in *English*. (Grove, Ill.) Northwest German Radio, 7.290, Hamburg, is on the air daily 2300-0430, 0600-1900; reports requested, will verify by letter and send photograph of transmitter; QRA is NWDR, Rothenbaumchausse 132, Hamburg 13, Germany. (ISWC, London)

Radio Sweden says the American Forces Network, Munich, is heard on approximately 5.880 from 1215-1330 in parallel with m.w. stations of A.F.N. This is not confirmed.

Gold Coast—ZOY, 4.915, Accra, heard around 1245 in Britain with weather forecast issued by the Gold Coast Meteorological Survey, followed by news; 1255 has popular melodies; then the announcement, "You have been listening to a broadcast on 61.04 meters from Accra, Gold Coast; good night"; signs with "God Save the King"; QRA is Senior Programmes Officer, Radio Accra, P. O. Box 745, Accra, Gold Coast. (ISWC, London)

Greenland—Godthaab, 5.942, is heard in Norway 1630-1740 but is weak; announcement in Danish is "God Aften. Her er Grenlands Radio." Program consists of news, weather forecast, music. *No English*. (Halvorsen)

Greece—Athens, 9.607, heard around 0200 with recordings; news in Greek 0225; Home Service. (Pearce, England) A Greek Communist outlet has been heard on 9.455 at 1400 (Bluman, Israel) Larissa, 6.745, heard in Newfoundland signing off 1600. (Peddle)

Guatemala—TGWA, Guatemala City, has returned to the air. It appears to run on 15.17 from 0725 to around 1500 or later on *weekdays;* Sunday sign-off is around 0900. Is using 9.763.6 (measured by Oskay, N. J.) from around 1800 to 2400 or later. Has many programs of beautiful marimba music. I wrote this station for details as soon as it returned to the air, but received (immediately) only a QSL card. The station listed Radio Nacional de Guatemala, "La Voz de Guatemala," Emisores: TGW-TGWA-TGWB-TGWC.

Haiti—4VRW, Port-au-Prince, after

broadcasting for years on 10.135 appears to have settled down on 9.790; heard mornings and evenings (EST) with good signal. (Ferguson, N. C.) Signs off 2145. (Grove, Ill.) Widely reported. Recently sent schedule of *weekdays* 0600-0830, 1200-1500, 1800-2200; *Sundays* 1200-1700; power listed 1.4 kw., but may have increased it by now. QRA is P. O. Box A-117, Port-au-Prince, Haiti. (Slutter, Pa.)

Honduras—HRA, 9.034, Tegucigalpa, noted evenings (EST) on this channel, usually with QRM from COBZ, 9.026. (Ferguson, N. C.)

Hungary—Widely reported is Budapest, 6.247.4 and 9.834.6 (measured by Oskay, N. J.) with news 1630; runs to 1800.

India—The Overseas transmission 1000-1040 is now on 15.29, 11.85 with news 1030; the 1400-1500 period is announced for 7.240, 9.620, 11.760, 11.850. (Pearce, England) Noted on 9.565 with news 2130, 2230. (Stark, Texas) The 15.19 channel appears to have been brought back into use, noted 2130 with news. (Fargo, Ga.) At long last, AIR, Delhi, is sending out a QSL card instead of verification letter. (Pearce, England) The card is blue and orange with a drawing of a station on it. (Cox, Delaware) AIR noted on 15.16, 17.78, at 2315 with news. (Balbi, Calif.) AIR, 4.84, Bombay, heard 1115-1125 with talk (*English*), then Indian program to 1230 closedown with chimes for 2300 IST; Calcutta, 4.880, heard from around 1030 to closedown 1200, mostly native. (Pearce, England)

Indonesia—YDA-2, 6.170, heard after 0530; chimes and station announcement 0630; in native. An Indonesian is heard on 4.85 at 1000-1030. (Balbi, Calif.)

Iran—GDX-area, Sweden, says EQB, 6.155, Teheran, has news 2230-2300.

Israel—At the time this was compiled, Kol-Israel, Tel-Aviv, was using approximately 8.900 afternoons (EST) to 1630 closedown; news 1530. By this time, it is likely that this channel (listed 9.000) will be in use by the World Zionist Organization for beaming overseas broadcasts from Jerusalem to World Jewry. Will beam to Europe, to North America, and other areas, and will use several languages including *English*. I hope to have full details next month. In the meantime, reports may be sent to P. O. Box 17, Hakirya, Israel. Israeli outlets now sign on at 2330, including Tel-Aviv, 6.830, and Haifa, 8.170; news 0700, 1530.

Italy—Current schedules of *Radio Italiana* from Rome are 1930-2055, 0500-0530, 0830-1300 on 11.810, 15.120; 1205-1700 on 9.630, 11.810; 1710-1925 on 11.810, 15.120. (Radio Sweden)

Jamaica—ZQI, 4.950, Kingston, has improved signal 1600-1730; news 1715 and headline news just before closedown; operates on 3.480 at 1930-2200.

Japan—The Japanese Broadcasting Corporation lists these current schedules—Home Service—JKH, 7.257.5, 1525-0900; JKI, 4.910, 1525-1755, 0255-0900; JKI-2, 9.655, 1725-0245; JKJ,

7.285, 1555-2200; JKM, 4.930, 0325-0900; JKM-2, 9.695, 1555-2200. Overseas Service—JBD, 9.505, 0255-0900; JBD-2, 9.560, 0255-0900; JBD-3, 15.225, 1750-0230, and JBD-4, 15.235, 1750-0230. (Pearce, England)

The 6.005 outlet is heard irregularly after 0100. (Balbi, Calif.)

WLKS, 6.105, Kure, opens daily 1530. (*DXSA News*, South Australia)

Kashmir—Srinagar, 4.865, is on the air 2130-2330, 0700-1030; on 7.270, 0100-0230. (Nordh, Sweden) The 4.865 channel heard in England 1030 with relay of AIR news from Delhi; native programs then to 1130. (Pearce)

Kenya Colony—New call for VQ7LO, Nairobi, is VQG1; frequency is 4.850 and BBC news is 1300, local news from the East African Standard 1315, closes 1400. (ISWC, London)

Korea—The North Korean (Communist-controlled) outlet on 4.500 heard from 0230, strong by 0330 on West Coast; 7.778 not heard lately, formerly was in parallel but with much weaker signal. (Balbi, Calif.) Fair signal in Louisiana on 4.500 at 0700. (Locke) Seoul, 2.510, So. Korea, good in California around 0900. (Dilg)

Lebanon—Beirut, 8.036V, now appears to have *English* at 1000-1100 when concludes period with "Knightsbridge March" instead of former "Pack Up Your Troubles." (Pearce, England) Heard in Newfoundland 1340-1600 (Peddle)

Luxembourg — Radio Luxembourg, 6.090, now relays *English* from its Lw. outlet on *Sundays* 1615-1900, *weekdays* 1730-1900. (*Short Wave News*, London)

Malaya—Red Network of *Radio Malaya*, 4.780, Singapore, heard in England 0900 with Chinese; signed off 1030 with *English* and "God Save the King." (Pearce)

Manchuria—Mukden, approximately 3.500, weak but readable in California around 0900; takes relay from Pekin (10.260) at 0730-0830 but does *not* carry the *English* 0830. (Dilg)

Martinique—Overseas sources report *Radio Martinique* on 9.990 at 0100-0118, but this has not been confirmed.

Mauritius—V3USE, 7.340, Forest Side, heard 2200 with news in *English*, 2235 in French. (*NATTUGGLAN*, Sweden).

Monaco—Monte Carlo, 6.035, 9.785, noted Sundays 0300-0330 with "Bringing Christ to the Nations" (*English*). (Cox, Delaware) Full schedule is *weekdays* 0100-0300, 0600-0800, 1215-1715; *Sundays* 0100-1715; on Sundays 1600-1700 has *English* program called "Monte Carlo Calling" (variety presentation by Evelyn Barnard).

Mozambique—CR7BE, 9.763, Lourenco Marques, noted in *English* 1000; leaves this channel around 1105. (Stark, Texas) Has had improved signals here in West Virginia lately on Sundays with request program (*English*) around 1045. This outlet uses many commercials.

New Zealand—ZL7, 6.080, and ZL4, 15.280, noted with BBC news relay

0600 and signing off around 0628. ZL7 has bad QRM.

Northern Rhodesia—ISWC, London, says ZQP is now using *both* 7.220 and 9.715 at 1000-1200.

Pakistan—Karachi is currently using 11.770.5 (measured by Oskay, N. J., but may vary as low as 11.768 at times) for news 0700, 1015, but when this was compiled was still on 11.885 for news 2100; Dacca, 15.335, is in parallel at these times. Dilg, Calif., has been hearing a *Radio Pakistan* outlet on approximately 7.670 with *English* identification around 0915; heard irregularly and signs off 0930; location unknown.

Fried, Mich., reports *Radio Pakistan* heard around 1100 on 11.885, 11.770, and 7.225; 11.885 carried separate program while the others were parallel.

Heard on 11.770 announcing use of 25-m. and 31-m. bands; however, could not be located in latter band. (Cushen, N. Z., via *Radio Australia*)

World Radio Handbook lists call of Karachi, 11.885, as APK-3.

Although Lahore has been widely reported abroad as heard on 11.740, at the time this was compiled I had reliable information that Lahore was as yet operating *only on m.w.*

Philippines—DZH-3, 9.500, Manila, heard in England from around 1645 with sponsored programs in *English*; at 1700 gives time as "6 a.m. Philippine Time." (Pearce)

Sanderson, Australia, reports a *new* Philippine outlet on approximately 4.980 at 0530 with music; she reports a station in Manila on 9.730 noted 0530 with music, may be (*new*) DZH7? *Radio Australia* says the 4.980 outlet has been heard closing 0900 giving m.w. call of DYBR, but noise was too high to read s.w. callsign.

Poland—Radio Polskie, 9.530, heard in New York 0000-0300 with strong signal but with QRM from BBC on 9.525. (Schild) Bluman, Israel, lists relay of Home Service on this channel 0100-0400, 0600-0800.

Portuguese West Africa—CR5ST, 9.615, Sao Tome, is testing 1300-1500 with Portuguese recordings; speech poorly modulated; QRA is Radio Clube de Sao Tome e Principe, Sao Tome, Portuguese West Africa. (Bluman, Israel)

Reunion Island—Krafft, Mass., reports he picked up *Radio St. Denis* on approximately 15.37 at 0030 on a Sunday some weeks ago; had news and identification in *English* (in which mentioned a resume in French); signal was 100 per-cent readable and fairly well above noise level. May have been test. Not confirmed. Is not listed in 19-m. band.

Roumania—Bucharest, 9.252, has had improved signal lately in East at 1500 when has news; continues to 1600 closedown. Usually has bad CWQRM and other QRM.

Saudi-Arabia—New regular schedule of Mecca, 725 kc., 3.960, 5.985, 9.645, 11.760, 11.950, in parallel, is 1200-1800. (Bluman, Israel)

Spain—"La Vox de la Falange,"

7,380, Madrid, informed Pearce, England, that it would shortly increase its power and that broadcasts in *English* would be inaugurated in response to requests from many *English*-speaking listeners. This expansion should have been effected by the time you read this.

Suez Canal Zone—An unidentified station heard some time ago by Gillett, South Australia, on 7.375 to closing 0830 may be the Forces Broadcasting Service at Kabrit. Was reported earlier to have tested on this channel.

Syria—Damascus, 6.000, 11.750 (moved from 12.000), has news 0530, 1400. (*GDX-aren*, Sweden)

Tahiti—Papeete has recently been using its *old* 6.982V channel in parallel with the *new* 12.080 frequency at 2315-2400. (Dilg, Calif.) The 6.982 outlet at times is the better of the two here in West Virginia. Has some *English* at times now.

Thailand—More recently, Bangkok appears to be using 6.240 instead of 6.010 for its native transmission around 0700-1030 (sign-off varies); 9.796 is in parallel. (Dilg, Calif.) At the time this was compiled, Bangkok was using 9.796 and 6.010 for news 0515, 0615.

Trans-Jordan—The Hashemite Jordan Broadcasting Station (self-styled "Hashemite Kingdom of the Jordan") at Jerusalem over s.w. outlet Ramallah on 7.075 is on the air daily 0045-0130, 0645-0730, 1100-1215 in Arabic and 1215-1300 in *English* (Bluman, Israel)

Turkey—Ankara is using TAP, 9.465, daily with news 1445; *English* program on Thursdays 1630; and Mailbag on Sundays 1630. Good signal here in West Virginia. According to announcements from *Radio Ankara*, its *new* 100 kw. s.w. outlet should be on the air early this year.

USSR—The Soviet outlet on 6.055 is used to China; signs on 0230; uses Chinese exclusively; others in parallel are 6.11, 9.545, 9.565 from 0230 to around 0430 when these are heard in Russian in parallel with 6.075. (Balbi, Calif.) Location is Komsomolsk for the 6.055 channel which relays Moscow to the Far East.

Schwartz, Vienna, reports Stalinabad on 7.440 with good signal after 1945, best 2030. (*NATTUGGLAN*, Sweden)

Vatican City—HVJ, 15.095, noted fairly good level with news 1000, but has had sideband QRM from Montreal, 15.090. (Fargo, Ga.) *Radio Sweden* reports that HVJ is now operating on 7.280 in parallel with 5.968 and 6.190; after 1530 the *new* outlet is badly jammed by Paris on same channel.

It is reported by Patrick, England, that money subscribed by Catholics all over Holland is being used to build a new 100 kw. *Philips* s.w. transmitter for the Vatican; it will be completed in 1950 and will be presented to His Holiness Pope XII on behalf of Dutch Catholics to commemorate the Holy Year that began Christmas Day, 1949.

Yugoslavia—Belgrade, 9.505, is widely reported 0115-0130 with news. In the Eastern U. S. has some QRM from GSB, 9.510.

* * *

One of the high-powered tubes used in the new short-wave transmitters of "Radio New Zealand" at Titahi Bay, New Zealand.

Press Time Flashes

At press time I was hearing *Radio Pakistan*, Dacca, on 7.670 at 0700 with news, in parallel with Karachi, 11.770.5; since I could not find Dacca on 15.335, it is assumed it may have moved to the 7.670 spot. If this is the case, the 7.670 outlet likely is in use as late as 1130.

J. M. Hill, production manager of CKRC, Winnipeg, Manitoba, Canada, informs me that the s.w. outlet which has been off the air will return early in 1950 on 11.720, with news at 1300, 1330, 1400, 1500, 1600, 1700, and 1800.

Radio Sweden has just issued an attractive *new* QSL card which is entirely in the *English* language. Sweden now has an *English* news review daily at 1345 on 6.065, 10.780.

The Radio Club of Sweden (SRK) has started a novel service for its *English-speaking* members; each month such members will be sent an *English* translation via airmail, giving most important DX items, while the club's regular bulletin in Swedish will follow via surface mail. This club reports *Radio Malaya*, 7.200, 9.712, Singapore, closing 1030 (Saturdays 1100), opens 0530; DZH-3, 9.500, Manila, *Radio Philippines*, closing 0900; that CR7BJ, 9.635, Lourenco Marques, is looking for a new channel and has been heard on 9.635, 9.640, and 9.670 at times; Lisbon, 11.027 and 15.165, noted parallel 1600-1615.

A more recent measurement of Budapest's 31-m. outlet was 9.831.5 instead of 9.834.6. (Oskay, N. J.) *English* now seems to vary at 1615 or 1630.

Radio Addis Ababa, Ethiopia, again seems to be using approximately 15.075 irregularly; noted on a Sunday in Sweden and in England around 1010-1100 sign-off with *English* religious broadcast.

Radio Sweden reports the clandestine Greek Liberty Station on 9.455

in Greek at 0700-0730, 1115-1145, and 1215-1245; in French 1330-1415.

At press time I was hearing the Forces Broadcasting Station Middle East, on 4.965 from 2330 opening.

Revised AIR winter schedules received via airmail are: *Delhi*—VUD2, 6.190, 2130-2330; 9.660, 0200-0400; 7.290, 0630-0800; 3.495, 0815-1230. VUD3, 15.290, 2030-2145; 9.680, 2200-2230; 11.810, 0200-0240; 17.760, 0300-0400; 11.830, 0730-0750; 15.29, 0830-0915; 6.010, 0930-1230. VUD4, 9.630, 2030-2230, 0200-0400, 0700-0750, 0830-1100, 1130-1230. VUD5, 15.190, 2030-2200; 15.160, 2300-2330; 21.510, 0230-0330; 17.840, 0600-0815, 0830-0915; 15.190, 1000-1040; 15.290, 1100-1230; 9.620, 1400-1500; 15.160, 1930-2015. VUD7, 9.565, 2030-2115, 2130-2200, 2215-2310; 17.830, 0230-0330; 15.160, 0430-0530, 0615-0730; 6.190, 0745-1045; 11.790, 1100-1330; 11.760, 1400-1500; 11.830, 1845-1900, 1945-2000. VUD8, 7.275, 2030-2230; 15.350, 0220-0250; 7.290, 0310-0320, 0340-0350; 7.275, 0700-0750, 0830-1330. VUD9, 11.790, 2030-2230; 9.680, 0220-0240; 15.290, 0300-0400, 0730-0750; 11.790, 0830-1100; 9.680, 1130-1230. VUD10, 7.225, 2030-2115, 2130-2200, 2215-2310; 17.780, 0230-0330, 0430-0530, 0615-0730; 7.225, 0745-1045; 9.660, 1100-1330; 7.240, 1400-1500; 9.630, 1845-1900, 1945-2000. VUD11, 11.850, 2030-2200; 17.780, 2300-2330; 15.190, 0230-0330, 0600-0815, 0830-0915; 11.850, 1000-1040, 1100-1230, 1400-1500, 1930-2015.

Bombay—VUB2, 6.150, 2100-2230; 9.550, 0215-0400; 7.240, 0630-0845; 4.840, 0900-1230. VUB3, 7.240, 2100-2230, 0215-0400; 9.550, 0630-0845; 7.240, 0900-1230.

Calcutta—VUC2, 6.010, 2030-2230; 9.530, 0200-0430; 7.210, 0600-0800; 3.305, 0815-1200. VUC3, 7.210, 2030-2230, 0200-0430; 9.530, 0600-0800; 4.880, 0815-1200.

Madras—VUM2, 6.085, 2030-2230; 9.590, 0200-0430, 0530-0630; 4.920, 0700-1200. VUM3, 7.260, 2030-2230, 0200-0430, 0530-0630, 0700-1200.

* * *

Acknowledgement

Many thanks for the usual FB cooperation; keep reports coming to Ken Boord, 948 Stewartstown Road, Morgantown, West Virginia, U. S. A. . . . . K. R. B.

Speaker Cabinet

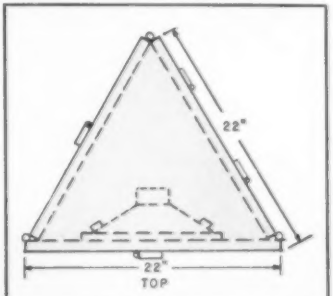
(Continued from page 47)

sion of some of the problems and characteristics of the various types of baffles may be of value to the experimenter.

One common problem encountered where low frequencies are reproduced at fairly high level is that of cabinet rattles. In the most objectionable form, these are usually high-frequency resonances excited by the sudden contact of two loosely separated portions of the baffle. The high audibility and nonharmonic character of these sounds make them a very undesirable accompaniment to bass passages. Firm contact or adequate damping is usually the solution to this problem. The first method is usually employed in conventional baffles where heavy construction and glued joints are commonly used. A combination of the two methods is desirable in a collapsible structure. The hinges or other means of connecting the various sections should provide a firm contact without any play, while sections that come in contact with each other may be lined with felt or other material to damp transient vibrations.

A related, but seldom mentioned, characteristic is the tendency of the baffle itself to act as a radiator or series of radiators. This often results in very uneven frequency response and the production of unpleasing standing wave patterns as well as related transient distortions. One of the causes of this appears to be the practice of coupling the loudspeaker rigidly to the baffle; as a result, the mechanical reaction of the moving speaker cone will cause the entire baffle to vibrate in different phases and amplitudes, resulting in the previously mentioned distortions. Although the mass of the speaker cone is small in comparison to the mass of the cabinet it should be realized that a fair sized enclosure has a much greater radiating surface than the speaker. In the enclosure shown, the effective radiating area of the cabinet is about twenty-five times as great as that of the speaker cone. Similarly, the coupling that often

Fig. 2. Top layout of the collapsible baffle.



exists through the floor of the room may be of considerable importance as loose flooring constitutes a source of possible low-frequency radiation. Under some conditions this effect is very noticeable and the operator may find it desirable to use some form of mechanical isolation, such as sponge rubber "feet" under the speaker enclosure in order to preserve greater uniformity of characteristics in different locations.

The photograph shows the speaker mounting method used with the collapsible baffle. A sponge rubber gasket is used to separate the speaker frame from the front of the enclosure while small isolating pads are used between the mounting nuts and washers and the rear of the speaker. Although not providing perfect separation between the speaker and the baffle, this arrangement appears to be of definite value in damping out sharp transients that would otherwise tend to shock-excite various cabinet resonances and rattles and a definite improvement in the smoothness of the low-frequency response appears to result.

Similarly, a common practice is to line the interior of the speaker baffle with sound absorbent material to reduce the effect of internal resonances. It is important to note that in speaker enclosures utilizing the back radiation from the speaker, such as the bass reflex, the acoustic phase inversion is usually effective only in regions where the wavelength of the sound is somewhat greater than that of the return path. Above a few hundred cycles the phase of the radiation from the return path tends to change greatly, producing alternate cancellation or reinforcement which, in turn, results in uneven response. By lining the interior of the enclosure with sound absorbent material the high frequencies in the back radiation tend to be attenuated and thereby produce smoother mid- and high-frequency response.

A number of modifications are possible with the baffle described. If appropriate locations are available, the rear of the cabinet may be left open to provide a modified form of corner radiator system. Although the triangular shape of the baffle was chosen for reasons of simplicity and mechanical rigidity, using another piece of wood for the back of the enclosure to make a four-sided unit will approximately double the internal area. Likewise, it is interesting to note that use of multiple speakers of similar characteristics in the same cabinet, as suggested by Goodell, tends to give a higher ratio of speaker cone surface to cabinet surface and tends to reduce the effects of cabinet vibration.

Total cost of the materials in the unfinished cabinet illustrated was slightly less than ten dollars including the cost of having the sides cut to dimensions at a local cabinet shop, thus making this an inexpensive addition to the soundman's equipment.

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Ultra-Modern WOR-TV

(Continued from page 37)

Theater. One studio is arranged for audience attendance and participation. The existing theater facilities in the New Amsterdam were adapted for television purposes as follows: one control booth was built under the orchestra in a space formerly used for storage, and the other was set up in a former projection booth.

The stage itself was adapted for television purposes by the addition of three ramps and the extension of the apron. The ramps extend radially from the stage at either end and from the middle. They allow the cameras great flexibility and freedom to dolly in and back.

A second studio, comprising three basic sets, was constructed in a portion of the theater's original balcony. The control room for these sets is located in the former projection booth.

Each studio is planned for three-camera operation, and each studio control room equipped accordingly. The cameras are *RCA* TK-10A models using the type 5820 image orthicon tubes.

Control room monitors, the synchronizing generators, and the stabilizing and distribution amplifiers are of the latest *RCA* design.

At the time of writing the larger of the two control rooms is also being used as a master control point until the permanent master control can be completed in WOR-TV's new studios in the "Television Center" on 67th Street, New York.

Facilities there include a master control room, a projection room, three studio control rooms, two large studios, and two announcing studios. Each of the three studio control rooms are identical, as regards facilities. Two of these control rooms face on corresponding studios.

Among the novel features incorporated in the 67th Street setup is the removal of all video operating personnel from the studio control rooms. This is done in order to minimize the number of people present in the control room during the actual production of programs. Located here is a program console, in which are mounted seven picture monitor tubes. Four of these monitors are used on the individual cameras for that studio.

Two may be switched for previewing incoming remote signals or film inserts, which may be a part of the studio show, and the seventh monitor is used as an outgoing line monitor for that particular studio.

The production man and a video switching engineer are seated at the control desk in front of the monitors. To the right of the video console is located an audio control console at which one audio man operates. Thus, the total personnel in the control room is reduced to three for producing a television show.

The video operators who set video and background levels on the individual cameras for all studios are located in what is called the "camera control center," a part of the master control room. Here, all of the camera control units with their picture monitors and oscillographs are centrally located for all studios in one console unit. The video operators at this point are in communication by wire with the directors and camera operators themselves. Their only function is to see that the cameras are electrically focused, and that the levels on the oscillographs are properly held. This system has a further advantage in that a video operator operating in one studio can quickly switch over to the control units of another studio, thus further minimizing the personnel requirements for the station.

Another feature of this system is a camera cable patch panel, located in the camera control center, which enables the quick patching of any one of the eight studio cameras' camera controls into any of 15 camera outlets in the two studios or "announce" booths when required.

For example, if it were desired to augment the four cameras in Studio A for a particular show with a fifth camera from Studio B, it is merely necessary to plug in the fifth camera control in the camera control center into the cable leading to Studio A, and the same video operator in the camera control center will have this control unit at his fingertips.

The two large "announce" studios are equipped with camera cable feeds to the camera control center, so that if a single camera shot of an interview or a news program is desired, it is merely necessary to patch in one of the eight camera controls to the "announce" booth cable.

The projection room adjacent to the master control room is equipped with four TK-20A film camera chains. Each film camera is fed by means of a multiplexer with several sources of slides or film. Included in these facilities are 35 mm. projectors, 16 mm. projectors, 2 x 2 slide projectors, and opaque projectors.

The film camera control units, with their monitors and oscillographs, are centrally located with the studio camera units in the camera control center. This further simplifies the operation in several ways.

The program control for the film equipment is located in the Studio C control room and is identical with each of the two live-talent studio control rooms. This control room enables the production personnel to put on an all-film program or to handle film inserts in a remote show.

The video switching system for each studio control room handles a total of twelve inputs. The switching is actually done by relays in the master control room, but controlled from the individual studio control rooms. This gives considerable flexibility to the switching of cameras between studios

and the handling of remotes in individual studio control rooms. Five banks of video switching relays are used with each studio switching system. One of these gives an output for the main program to the master control. Two other relays are used to switch the two preview monitors to any of the twelve inputs, as desired. Two other outputs are provided to feed a mixer amplifier for "super positions," "lap dissolves," and any other special effects which may be required in the future.

The twelve inputs are set up normally so that eight inputs are camera signals, that is, video and blanking only, three for composite signals, such as incoming remotes, and one the "effects" input to the program output.

The master control switching facilities also present a novel system, at this time. The system is designed for six composite video inputs and six audio inputs, with four outgoing channels. The system provides for presetting on both audio and video signals with either simultaneous audio-video switching or separate audio and video switching. Two of the standard *RCA* console sections are used for each outgoing channel. One of these sections houses a TM-5A master monitor with picture tube and oscillograph, while the adjacent section houses the preset control buttons and tally lights. A master "trip" button appears on each of the four channel sections, enabling the operator to trip all four outgoing channels when required. A "local" or "master" control switch on each of the sections also enables the operator to set up an individual channel for separate control when so desired. The system is extremely flexible, and it is anticipated that it will fulfill all of the requirements for television master control switching in the near future.

Mobile Units

Approximately half of all WOR-TV programming is remote, and fed to the transmitter from WOR-TV mobile units. These were made to order according to WOR-TV engineering specifications. Each unit contains a three-camera setup with associated sync generators and monitors.

Maintenance of these mobile units and their equipment is especially important since so much of the station's program schedule depends on their smooth and accurate functioning.

The signal from any remote pick-up can be beamed to the 550-foot level of WOR-TV's New Jersey transmitter. A microwave relay house at that level picks up the signal and feeds it directly to the transmitting equipment below. When required, it can be routed to the master control in the city for switching.

In the over-all planning of WOR-TV's technical facilities, the emphasis has been placed on obtaining flexibility and ease of operation to insure smoother and better programming on the air.

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Technical BOOKS

"THE TECHNIQUE OF RADIO DESIGN" by E. E. Zepler. Published by *John Wiley & Sons, Inc.*, New York. 388 pages. Prices $5.00. Second edition.

This book is based primarily on the experiences of a radio designer encountered over a period of years. In contrast to many technical books it deals with the problems which occur most frequently rather than the abstract problems which are seldom encountered in engineering practice.

The author believes that the real technique of experimental work starts when unexpected complications occur while following a design, while the technique of *design* calls for foreseeing complications that may arise and overcoming them before serious trouble develops. With this in mind the author has tried to instill in the reader a feeling for the right order of magnitude, a quick grasp of essential facts, and the use of common sense in approaching design problems.

In developing his theory the author has devoted considerable space to a discussion of fundamentals without slighting his material on practical applications. This new edition includes a rewritten and expanded chapter on receiver noise and much more space has been devoted to negative feedback.

The author has avoided complicated mathematics and has stressed practical applications. Design engineers should find this book of value in coping with everyday design problems.

• • •

"FACSIMILE" by Lee Hills & Timothy J. Sullivan. Published by *McGraw-Hill Book Company, Inc.*, New York. 311 pages. Price $3.50.

Written in layman's language, this book is the story of facsimile from its earliest beginnings in 1842 to present-day methods and equipment.

Since the authors are managing editor and facsimile editor, respectively, of *The Miami Herald*, one of the pioneers in the facsimile transmission of newspapers, their material is both interesting and practical.

The early chapters of the book are devoted to a discussion of the medium, a history of facsimile, and the present and future applications of the art. They then go on to discuss "Colorfax" and "Ultrafax," two of the recently developed facsimile systems. There is plenty of down-to-earth data on applying for a facsimile broadcasting license, facsimile programming, and the various techniques for presenting copy for facsimile transmissions. Several chapters cover some of the technical aspects of how facsimile works but the discussion is non-technical and need not tax the comprehension of the veriest layman. A chapter which will be of particular interest to the faculties of journalism schools is one entitled "Teaching Facsimile" and covers

the editing, make-up, equipment operation, campus editions, and lecturers' observations.

A concluding chapter summarizes the future which is in store for the medium.

The book is interestingly and entertainingly written and should answer many of the questions about facsimile that have heretofore gone unanswered.

* * *

"MAINTENANCE MANUAL OF ELECTRONIC CONTROL" edited by Robert E. Miller. Published by *McGraw-Hill Book Company, Inc.*, New York. 296 pages. Price $4.50.

This book is a compilation of a series of articles on the subject of electronic control maintenance which originally appeared in *Electrical Construction and Maintenance*.

Each chapter has been written for the electrical and electronic technician by a specialist in his field. It is, simply, a practical installation, maintenance, and service manual written for the men whose job it is to see that industrial equipment using electronic controls is kept in top working condition.

The first chapter is introductory and discusses the various circuits encountered in the electronic control field. It is written in non-technical and easy-to-understand form and serves as background material for subsequent chapters.

The text then covers such subjects as general considerations in installing and maintaining electronic control; the cathode-ray oscilloscope, what it is and how to use it; installing, maintaining, and servicing electronic relays and timing relays; installing, maintaining, and servicing photoelectric relays; installing, maintaining, and servicing electronic motor control; and installing, maintaining, and servicing electronic resistance-welding controls, electronic temperature-control systems, and sealed-ignition rectifiers.

All of the contributors are electronic specialists with *General Electric Company* and they have illustrated their articles with excellent photographs and complete diagrams. Sixteen reference charts covering troubleshooting, inspection schedules, cable sizes, water flow and temperature, tube and circuit connections, and abnormal conditions and protection data add considerably to the practical value of this book.

* * *

"INTERNATIONAL RADIO TUBE ENCYCLOPAEDIA" edited by Bernard B. Babani. Published by *Bernards (Publishers), Limited*, London. 410 pages. Price 42 shillings.

This is a comprehensive work covering tube types used by the Armed Services of the British Commonwealth, the United States, and Europe in addition to the C,V. and normal civilian types. Nearly 15,000 tubes are listed in tabular form with such information as base, pin connections, top or side caps, and manufacturers. This tabular data is all coded and related to

standardized instructions which have been given in fourteen languages. Included are instructions in English, French, Italian, Spanish, Portuguese, German, Dutch, Swedish, Norwegian, Danish, Russian, Polish, Czech, Hebrew, and Turkish so that practically any potential user can apply this material.

There are ten main sections covering receiving tubes, triode transmitting tubes, transmitting tetrodes, pentodes, and other transmitting tubes having more than five elements, rectifiers, thyratrons, regulator and control tubes, tuning indicators, cathode-ray tubes, photo tubes, and rare tubes and their equivalents.

There are six pages of tube base diagrams and a comprehensive listing of manufacturers and their addresses.

One valuable feature of this encyclopedia is the fact that the publishers are planning to issue an annual supplement which will give information on tube types not included in the original text and data on new tubes in production. In this way the book will not become dated.

For those whose work involves radio tubes of all types and makes, this encyclopedia is an important contribution to the literature.

* * *

"TELEVISION FOR RADIOMEN" by Edward M. Noll. Published by *The Macmillan Company*, New York. 588 pages. Price $7.00.

The author, who is well-known to readers of RADIO & TELEVISION NEWS as a contributor of television articles, has prepared this comprehensive instruction manual for the radio technician, electronic technician, radio amateur, experimenter, and the technical school student.

Although it is assumed that the reader of this book will be thoroughly familiar with radio theory and circuits before tackling television, the author takes it for granted that the student is a tyro in the television field and proceeds accordingly.

The book is divided into fourteen chapters, the first of which is devoted to an introduction to television and the last to a discussion of practical television mathematics. Although mathematics appears throughout the text where needed to present a complete treatment of the subject, the practical television technician can safely ignore the formulas, interpretations, and derivations without losing any of fundamentals.

The balance of the book is devoted to a discussion of the composite television signal, the general operation of the television system, r.f. and i.f. systems, video amplifier systems, television picture tubes, sync and inter-sync systems, sweep systems, FM sound system, large screen and projection television, television receiver antennas, installation, adjustment, and operation of television receivers and antennas, and alignment and trouble-shooting.

Since this book is intended to be

used for self-instruction or as a classroom text, each chapter is followed by a list of questions by which the student can check his grasp of the subject matter covered in that chapter. A bibliography listing other books and articles on the same subject is also included at the end of each chapter.

Typical circuit diagrams, block diagrams, and photographs are liberally used throughout the text and assist materially in clarifying the subject matter.

This book should find a vast audience among the thousands of radio service technicians who are seeking a practical and authoritative text on the subject of television.

* * *

"PRACTICAL TELEVISION SERVICING AND TROUBLE SHOOTING MANUAL" by The Coyne Staff. Published by *Coyne Electrical & Radio-Television School*, Chicago. 392 pages. Price $4.25.

Especially compiled for the radio technician, this newest *Coyne* text covers such subjects as television servicing methods, tuners, television sound problems, alignment methods, video i.f. amplifiers, traps for interference, picture tubes, video detector and amplifiers, deflection methods, the sync section, sweep oscillators and generators, sweep frequency auto controls, sweep outputs, high voltage power supplies, low voltage power supplies, trouble location with test patterns, television antennas, and u.h.f. and color television.

One particularly valuable section deals with the test instruments needed in television servicing, their use, and method of employing them in test procedures.

The text is liberally illustrated with diagrams, graphs, and photographs. The photographs have been taken of the various receiver sections just as they would appear to the service technician working on the set.

An unusual feature in the makeup of the book is that the chapter dealing with u.h.f. and color television has the illustrations printed in colors as they would appear on the screen of a color TV receiver.

The experienced radio technician should experience no difficulty in grasping the material as presented in this book, as the text is clearly and concisely written. The book would also be suitable for the student studying television by self-instruction.

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Spot Radio News

(Continued from page 18)

commercial operation of the station was discontinued and the Navy assumed control. Control was maintained by the government until 1919, when the newly-formed *RCA* became the operator and a chain of historic events followed. The Commissioner revealed how for the first two years, Chatham, the receiving site of the system erected by Marconi, was a point-to-point station, exchanging messages with Germany, Norway, and Sweden. In 1921, as plans were set up to transfer all point-to-point activities to the then newly-built Radio Central on Long Island, a 500 kc. transmitter with the famous call letters WCC was installed at Chathamport to serve as a ship-to-shore link. A year later, a second WCC transmitter was installed to operate at what was then considered to be an ideal frequency, 2200 meters. The 500 kc. transmitter assumed the call letters WIM.

"However," continued the Commissioner, "with the addition of the 2200-meter equipment, interference problems increased. To eliminate transmitter interference at the increasingly busy receiving positions meant the removal of the transmitting equipment a considerable distance from the receiving antennas. And thus WCC's transmitters were moved to Marion."

Marion and Chatham became the scene of many record-book events, the Commissioner revealed, recalling the incident which has become a legend in brass-pounding history. In 1927, when the Prince of Wales was on his way to this country aboard the *SS Berengaria*, a severe windstorm broke contact at several points between Chatham and Marion. The break, coming at an hour when message traffic to and from the British liner was at its peak, caused a near panic.

"With 300 messages waiting to be radioed to the vessel," reminisced the Commissioner, "one of the crack operators, carrying his telegraph key, set out through the gusty night, feeling his way in the dark from pole to pole until he spotted the break nearest Marion. He connected his telegraph key into the line, and in this unorthodox manner, proceeded to operate the Marion station transmitter, until the last of the messages had reached the *Berengaria*."

THE TAXICAB report, delivered by Commissioner George E. Sterling during the annual meeting of the National Association of Taxicab Owners in Buffalo, disclosed that today there are approximately 2700 radio cab systems, with a total of 55,000 cabs authorized. An investment of nearly $30,000,000 is involved in radio-cabs now in operation, said the FCC spokesman.

According to the Commissioner, within three to five years, 90 per-cent of all cabs will be radio equipped.

"The radio-less cab will be as much of a rarity as the surrey with the fringe on the top," he declared.

Describing the advantages radio offers to the cab, the Commissioner said: "Radio means greater safety for the passenger and for the driver, as the driver is always in ready communication with the dispatcher who can send police aid or other assistance. . . . The radio-equipped cab, ranging far and wide over the city streets at all hours of the day and night, is also proving a valuable ally to the local authorities in the reporting of fires and accidents, and in facilitating rescue work in floods and other disasters. . . . Even the emergency delivery of babies which occurs from time to time in cabs has been facilitated by the cabbie's ability to summon assistance to supplement his own versatile talents. . . . So rapidly has two-way radio proved itself that today, only four years after it was introduced on an experimental basis, it has been authorized by the FCC for two-thirds of all the taxicabs in the country."

FREEDOM OF THE AIR, as viewed by the FCC, served as the focal topic of an engaging talk by FCC Headman Wayne Coy, delivered at Amherst College.

Admitting that some of the Commission's actions do restrict a licensee's freedom, Coy explained that the control is actually of a friendly and helpful nature to the operator and public, too.

Expounding this view, he declared that the rulings . . . "restrict the freedom to be unfair . . . use a publicly-owned frequency for whims and caprices . . . use a scarce frequency out of the public domain that belongs to all the people to dole out time to pets or use it for his own interests and withhold it from those groups with whom he happens to differ. . . . Abridge his freedom to dodge his responsibility to operate his station as an open forum for all the conflicting interest of the community instead of as private chattel to do with as he will. Abridge his freedom to evade responsibilities as a trustee. . . . For my part, I conceive it my duty to make every effort to curtail the freedom of radio station licensees to be unfair or to use their licenses solely for their own private benefit rather than for the public interest."

AN EIGHT-YEAR program to extend the use of radio throughout India is now under way, according to a report from the International Broadcasting Union, Geneva. When the plan is completed, broadcasting stations in India will serve ten times their former areas, or about 80,000 villages, as compared to some 5000 at present.

Reporting on the increase in receivers in Japan, the Civil Communications Section of General Mac-

Arthur's command in Tokyo stated that there are now 3,000,000 more sets in operation since '45, or about 8,000,000 receivers in approximately half the homes in the land.

There has been quite a rise in receiver use in Great Britain. According to Geneva reports, there are over 12,000,000 sets now licensed, of which about 170,000 are television models.

The Bonn transmitter, in the British zone of Germany, now operating on 400 watts, will soon have its power increased to 5 kw., according to the International Broadcasting Union. The transmitter, now located in a wooden hut, and placed into operation a few days before the German Confederation went into effect, will be housed in a streamlined stone building, now being erected. This transmitter forms part of a group of synchronized stations located in Hanover, Flensburg, Osnabrück and Berlin, all operating on 1350 kc.

ALL OF INDUSTRY was shocked to hear of the death of that distinguished leader in scientific and industrial research, Dr. Frank B. Jewett. A former president of the National Academy of Sciences, and the *Bell Telephone Laboratories*, his work in radio and allied fields had been applauded throughout the world, with such awards as the Edison Medal, the Faraday Medal of the Institute of Electrical Engineers, the Franklin Medal, and the John Fritz Gold Medal, highest American engineering honor.

He was recently awarded the Hoover Medal for 1949 for . . . "distinguished public service," and the presentation was to have been made during the winter meeting of the American Institute of Electrical Engineers.

Under his leadership at the *Bell Laboratories*, many significant advancements were recorded. His engineering research, which made possible the transmission of speech by telephone lines across the continent, and the all-important network operation, was an epic achievement which will never be forgotten . . . . L. W.

"Slugger has the fight in the bag—Kidd's punches are all going wild!"

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SALE

FOR Sale 3 Webster No. 156, 78 RPM automatic Record Changers equal to new condition, price $15 each, FOB, New York. Norman Davis, 395 Ocean Ave., Brooklyn 26, N. Y.

PRACTICALLY new Eicor Tape Recorder, Roll of Tape with code up to 15 W.P.M. $95.00. Gardner Tape Machine, 10 rolls of tape $12.50. Phono & key oscillator mounted on one panel $8.50. F. H. Boyd, Ashton, Ill.

CODE Practice Tapes. Radiotelegraph. For school and individual use. Fit standard phototube keyers. $2.50 each, postpaid. For list write: Ultradyne Electronics, Oswego, Ore.

PROJECTION Television sets 16"x21" picture, UST, used, with AM-FM Short wave: Cabinet 5½' x3½'x19" complete $150.00. Murray Barlowe, 880 59th St., Brooklyn 20, N. Y.

FRANK Cotton, Omak, Wash., has McMurdo Silver Test Instruments for Sale. Reasonable.

ANTI-SLIPSTIK for dial cords and belts. An economical hard crayon that licks the most irritating jobs when applied according to directions. Actually preserves and strengthens old and new cords. Money back guarantee. Send dollar bill and this ad to Walcor, 603 Sherman Ave., Peoria 5, Ill.

WEBSTER Chicago record changer and wire recorder replacement parts. We ship everywhere! Friend's Wholesale Distributors, 106 N. 6th St., Philadelphia 6, Pa.

NATIONAL TV7W television rec. with lens, 3 months old, and Hallicrafter SX16 receiver. Make offer. Alvin Olberg, Clearbrook, Minn.

SURPLUS: BC457, $5.95, BC458, $5.95, ARC5 T22, $9.95. Used, good condition. Other Surplus and Amateur items. Write for complete list. Albert J. Arnold, Box 706, Amarillo, Tex.

CABLES & Wire. Multi-conductor #18 to 30 AWG solid or stranded copper. Cotton, shielded, or weatherproof plastic covering. Single conductors or twisted pairs. Write for quotations. Tel-Rad Company, 61 Allyn St., Hartford, Conn.

RECORD Changer Parts for leading makes. We ship everywhere. Friend's Wholesale Distributors, 106 N. 6th St., Philadelphia 6, Pa.

PHOTOFLASH Ignition Transformer, 15,000V, $1.95, regular $4.50. Charger, 2V Wetcell, $1.95, regular $4.95. Universal Battery Tester, $3.95, regular $15.00. Modelectric Products, Asbury Park, N. J.

NOTICE: Surplus Radio Equipment, parts and supplies. Write John R. Aab, Radio Division, Spartan Aero Repair, Municipal Airport, Tulsa, Okla.

RADIO Diagrams under seven tubes, 30c; over six tubes, 60c; Record Changers, 60c; Television Diagrams with service data, $1.00 up. State manufacturer and model number. Kramer's Radio Service, 36 Columbus Ave., New York 23, N. Y.

BARGAINS. New and reconditioned Hallicrafters, National, Collins, Hammarlund, RME, Meissner, other receivers, tuners, television receivers, transmitters, amplifiers, speakers, etc. Lowest wholesale prices. Terms. Shipped on trial. Liberal trade-in allowances. Write Henry Radio Butler, Mo., and 11240 W. Olympic, Los Angeles, Calif.

BARGAIN Hunting? Radio Servicemen write Sensational catalog. Henshaw Radio Supply, 3619 Troost, Kansas City 3, Mo.

LOWEST Prices Radio Tubes, parts. Bargain lists, 5c. Potter, 1314 McGee, Kansas City 6, Mo.

HOTTEST surplus list in the country. Electronics-Hydraulics, Aircraft Gadgets. Dick Rose, Everett, Wash.

PARTS for articles described in this magazine. Reasonable. Leo J. Vince, W8EYA, 2805 E. 117th St., Cleveland 20, Ohio.

FIVE Element TV Yagi Beams, High Band, $6.75; Low Band, $8.50. Aluminum Tubing, etc. Willard Radcliff, Fostoria, Ohio.

CARBON Tetrachloride, cleaner, solvent, 27 oz., $1.50. Polystyrene high frequency coil and splice dope, $1.00 pint. Special thinner, 65c pint. Craft Chemical Lab., 453½ E. Exchange St., Akron 4, Ohio.

COAXIAL Cable. 100 feet $3.00; Sample 10c. Harry H. Van Dick, Box 236, Little Falls, N. J.

TUBES, parts. Bargain sheet. Sonoret Radio Co., 36 Woodbury St., Wilkes Barre, Pa.

ALL Steel T.V. Towers which can be erected to 70' or more. Build to climb. Shipped direct from the factory at $8.50 F.O.B. per 10' section. Weight 20 pounds per section. Write for more details. The Youngstown Steel Towers, 1316 Wilson Avenue, Youngstown 8, Ohio.

WANTED

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USED Correspondence Courses and Educational Books bought, sold, rented, catalog free. Educational Exchange, Summerville, Ga.

MISCELLANEOUS

"RADIOBUILDER" for Crystal, tube Experimenters. 3 issues 25c. Catalog: Laboratories, 578-H, San Carlos, Calif.

WANTED Sales Agent. Important nationally known manufacturer has developed lowest cost paging and alarm system now produced. Suitable for all medium sized factories, offices, hospitals, retail stores, restaurants, banks, etc. Our own salesmen cannot handle this product because they cover different trade. Exclusive agent appointments will be made at once, prefer man with small sales organizations now covering above mentioned outlets. Liberal commission and special discounts on samples. Write fullest qualifications to President, Chimes & Signals, Inc., Dept. SA-8, Madison & Redbank Roads, Cincinnati 27, Ohio.

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CIRCULAR Saw Blades, 8" diameter; Sample $2.00. Van Dick, Little Falls, N. J.

New TV Products

(*Continued from page 134*)

phasing control, selective directivity without mechanical rotation, substantial reduction or elimination of "ghosts" and nuisance interference, and high gain throughout the video band have been achieved with this new type of built-in antenna, according to the company.

The chassis carries 26 tubes plus 4 rectifier tubes. The sets use all-glass picture tubes.

DU MONT'S 15-INCH CONSOLE

The new 15-inch television console recently introduced by *Allen B. Du Mont Laboratories, Inc.*, Passaic, New

Jersey has been designated the "Wellington."

This receiver provides a 132 square inch direct-view picture and has the new improved *Du Mont* high-performance chassis. In addition to television reception, the new set provides both AM and FM radio coverage, and three-way record reproduction.

The "Wellington" also includes such features as the Inputuner, a Local-Distant Switch, and the company's square station selector dials, for both AM and FM reception. The combination is housed in a traditional Georgian cabinet of mahogany veneers. The set uses 29 tubes, plus 6 rectifiers, and the 15-inch cathode-ray tube.

"FAMILY THEATER SERIES"

The *Crosley Division* of *Avco Manufacturing Corporation*, Cincinnati, is presenting a new series of television receivers which incorporate an exclusive theater-type direct viewing screen.

Designed to give observers the effect of actually being in the theater, the new receivers are housed in mahogany console and table model cabinets with 12½ and 16-inch direct-view picture tubes that are prominently mounted and shielded against conflicting reflections by a projecting stage formed by the top, sides, and bottom of the cabinets.

Three models in the "Family Theater Series" are currently available, including two consoles and one table model. —30—

INDEX OF Advertisers

FEBRUARY 1950

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

PHOTO CREDITS

Pages	Credit
36, 37	Wolf-TV
43	Lee Portner
48, 49	Don Dooner
51, 52	Radio Craftsmen
56, 144	"Radio New Zealand"
110	AFCA
118	Acme
121	General Electric Company
126	U.S. Army Air Force

ERRATA

In the article "Unity Returns to Ham Radio" appearing on page 55 of the December 1949 issue, the figures on the results of the 50.0 mc. poll should show that the vote was 66% against the assignment of exclusive c.w. frequencies in the 50.0-50.1 mc. portion of the band.

• • •

There are several corrections which must be made in the article "A Horn-Type Transducer of Minimum Dimensions" by R. Doby and G. Augspurger, Jr., appearing in the November issue, according to the authors.

On page 55, the dimensions of Fig. A-1 should be 17" x 8½" x 24" instead of 16" x 9" x 20". For Fig. E-5, change 23½" to 24" and 14¼" to 17" taken at midpoint. In Fig. J-9 change 23½" to 24". On Fig. G-8 change 12" to 13" and 37" to 39". On Fig. C-3 change 9" to 8½" and 7¼" to 5" taken at a point 22" up from the base. For Fig. B-2 change 37" to 39", 16" to 17" and 32" to 34".

The location of the relief ports as well as their design is optional. Locating them on Fig. G-8 conceals them from the front of the unit.

Fig. H-7 should not be laid out until the remainder of the cabinet is constructed and then its dimensions should be made by actual measurement from the individual transducer.

Mr. George Augspurger, Jr., has kindly consented to answer readers' questions if they are addressed to him at 4618 North 6th Street, Phoenix, Arizona.

"Always at the television set, he's such a baseball fan. Turn the volume up, dear, so we can find out what the score is!"

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w data ...

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1U4	6AL5	6BJ6	6X5	12C8	60B5
1U5	6AQ5	6C4	7C4, 1203A	12H6	60C5
3A4	6AT6	6J6	12A6	12S8GT	83
3Q4	6AR5	6P5GT	12AL5	12SH7	117Z3
3S4	6AU6	6S8GT	12AT7	12SN7GT	9001
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2C22, 7193	.18	6K6GT	.42	25W4GT	.79	826	.42
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2X2	.37	6V6GT	.69	NR74	.29	1619	.29
6AV6	.43	6W4GT	.72	211, VT4C	.49	1625	.37
6BH6	.62	6X4	.64	316A	.49	1626	.35

1629 ..... $.29
9002 ..... .30
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.02 mfd 7 for $1		.05 mfd 10 for $1	
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.1 mfd 12 for $1		2 mfd	4 for 1
.2 mfd 8 for 1		2x.25 mfd	6 for 1
.5 mfd 5 for 1		2x.5 mfd	5 for 1
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2 mfd 2 for 1		2x2 mfd	3 for 1
4 mfd 1.25		2x4 mfd	2 for 1
8 mfd 1.2		2x8 mfd	1.25
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500 Wvdc		1000 Wvdc	
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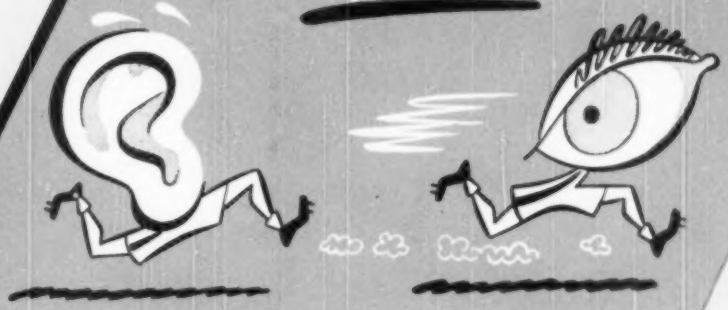
DEPT. 2RN SIX CHURCH ST. NEW YORK 6, N.Y., U.S.A. – CORNER CHURCH & LIBERTY STS. ROOM 200

PRINTED IN U. S. A.

THE EYE IS QUICKER THAN THE EAR



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HYTRON

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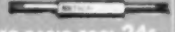

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